Results Of Research in 1961

by the

Agricultural Experiment Station

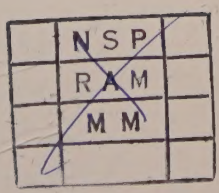
of the

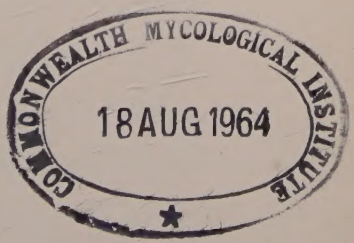
University of Kentucky

(Filing Code 24-2-1)

74th Annual Report

of the Director





LETTER OF TRANSMITTAL

To His Excellency, Hon. Bert T. Combs,

Governor of Kentucky

Sir: In accordance with an act of Congress, approved March 2, 1887, entitled, "An act to establish Agricultural Experiment Stations, in connection with the Agricultural Colleges established in the several states under the provisions of an act approved July 2, 1862, and under the acts supplementary thereto," and of the act of the Legislature of the State of Kentucky, approved February 20, 1888, entitled, "An act to accept the provisions of an act passed by the Congress of the United States, approved March 2, 1887, for the establishment and maintenance of Agricultural Experiment Stations in connection with Agricultural Colleges established by the several states and territories under the act of Congress approved July 2, 1862," I herewith submit the seventy-fourth annual report of the Kentucky Agricultural Experiment Station for the period ending Dec. 31, 1961.

Very respectfully,

William A. Seay, Acting Director

March 1, 1962

UNIVERSITY OF KENTUCKY

Board of Trustees, 1961

Bert T. Combs, Governor, Chairman, ex-officio
Wendell P. Butler, Superintendent of Public Instruction, ex-officio
Emerson Beauchamp, Commissioner of Agriculture, ex-officio
William F. Foster, Mayfield
Mrs. Paul G. Blazer, Ashland
R. P. Hobson, Louisville
Harper Gatton, Madisonville
Paul B. Hall, Paintsville
Clifford E. Smith, Frankfort
Floyd H. Wright, Lexington
Robert Ward Bushart, Fulton
Hershell B. Murray, West Liberty
Ralph Angelucci, Lexington
J. Stephen Watkins, Lexington
Robert Hillenmeyer, Lexington
Aubrey Brown, Lexington (Faculty)
Thomas D. Clark, Lexington (Faculty)

Agricultural Experiment Station Staff

Fiscal Year, July 1, 1960-*June* 30, 1961

ADMINISTRATION

Frank G. Dickey, President
Frank J. Welch, Dean and Director. Leave March 1961
W. A. Seay, Acting Dean and Director
W. P. Garrigus, Associate Director
Frank D. Peterson, Vice President of Business Administration
G. J. Ruschell, Associate Business Manager. Military. Leave October 25, 1961

.... AGRICULTURAL ECONOMICS ....

Brown, A. J., Department Head and Professor
Binkley, Wendell C., Associate Professor. Military Leave 10/21/61
Bondurant, J. H., Professor
Byers, George B., Professor
Card, Dana G., Professor
Clark, Carl M., Associate Professor
Criswell, James L., Assistant Professor
Fuqua, Joe, Assistant Professor
Gooch, Ernest D., Jr., Assistant Professor
Halter, Albert N., Associate Professor. Resigned 9/9/60
Johnson, Paul R., Assistant Professor
Keller, Luther H., Instructor. Resigned 10/3/60
Minton, Willard H., Assistant Professor
Paris, Donald, Assistant in Agricultural Economics. Resigned 9/3/60
Pearson, James L., Assistant Professor
Phillips, C. D., Professor
Redman, J. C., Professor
Roberts, John B., Professor
Rudd, Robert W., Professor
Shuffett, Dallas M., Associate Professor
Smith, Eldon D., Associate Professor
Thompson, James F., Associate Professor
Stovall, John G., Assistant in Agricultural Economics. Effective 8/1/60
Young, Harold, Assistant in Agricultural Economics. Effective 10/16/60

AGRICULTURAL ENGINEERING

Parker, Blaine F., Department Head and Professor
Brooks, Jesse B., Associate Professor
Bunn, Joe M., Assistant Professor. Effective 8/1/60
Kelley, James B., Professor. Deceased 12/23/60
Smith, Edward M., Associate Professor
Smith, Samuel Warren, Assistant in Agricultural Engineering
Walker, John N., Assistant Professor. Effective 8/15/60

AGRONOMY

Webster, G. T., Department Head and Professor
Amos, Dan F., Instructor
Bailey, Harry H., Associate Professor. Return from leave 6/16/61
Bortner, C. E., Professor
Chapman, Richard A., Professor
Burrus, Paul B., Jr., Assistant Professor
Diachun, Stephen, Professor
Dicken, John C., Manager of Seed Stocks
Doll, Eugene C., Associate Professor. Resigned 12/31/60
Duncan, William G., Associate Professor
Evans, Kenneth, Assistant Professor. Transferred to Agricultural Extension 4/1/60
Fallis, Robert W., Assistant in Agronomy. Special Assignment 10/1/60
Fergus, E. N., Professor
Finkner, Verne C., Associate Professor
Freeman, J. F., Associate Professor
Hamilton, James L., Assistant Professor
Hampton, Raymond E., Associate Professor. Effective 10/15/60
Harrison, John S., Instructor
Hatfield, Albert L., Assistant Professor
Henson, Lawrence, Associate Professor
Hiatt, Andrew J., Assistant Professor
Hutcheson, Thomas B., Jr., Associate Professor
Johnson, E. M., Professor
LINK, Leo A., Assistant Agronomist
Loeffel, Frank A., Associate Professor
Massey, Herbert F., Professor
Richards, H. R., Assistant Professor
Shane, James F., Assistant Professor
Stokes, Granville W., Associate Professor
Stroube, William H., Associate Professor
Taylor, N. L., Associate Professor
Taylor, T. H., Associate Professor
Templeton, William C., Jr., Professor
Todd, Jack R., Assistant Professor
Valleau, W. D., Distinguished Professor of Plant Pathology. Special Assignment 7/1/61
Wallace, Allen M., Assistant Professor

ANIMAL HUSBANDRY

Garrigus, Wesley P., Head of Department and Professor of Animal Husbandry
Ayer, R. L., Assistant in Animal Husbandry, Resigned 1/31/61
Barber, Harald, Head Herdsman. Deceased 8/6/60
Barnhart, Charles E., Professor
Boyd, Leroy H., Assistant in Animal Husbandry
Bradley, Neil W., Assistant Professor
Buck, Charles F., Associate Professor
Cathey, Ted W., Assistant in Animal Husbandry
Dutt, Ray H., Professor
Grainger, Robert B., Associate Professor
Hall, Robert J., Assistant in Animal Husbandry
Hamilton, O. D., Laboratory Assistant
Henry, Amanda H., Assistant in Animal Nutrition
Jones, Bernard N., Jr., Assistant in Animal Husbandry. Effective 2/1/61

Kemp, James D., Professor
Little, Charles O., Assistant Professor. Effective 9/19/60
Mitchell, George E., Jr., Associate Professor. Effective 9/8/60
Reese, Clint M., Assistant in Animal Husbandry. Effective 10/6/60
Selke, Marvin Ray, Instructor
Shimfessel, Othal, Assistant in Animal Husbandry. Resigned 1/31/61
Steele, Dewey G., Professor
Varney, William Y., Assistant Professor
Whitaker, M. D., Assistant in Animal Husbandry. Resigned 2/15/61
Woolfolk, Patch G., Professor

ANIMAL PATHOLOGY

Hull, F. E., Department Head and Professor
Behlow, Robert F., Professor
Bryans, John T., Professor
Cheatham, Mary, Assistant in Animal Pathology. Effective 2/8/61
Doll, Elvis R., Professor
Drudge, Harold, Professor
Johnson, Catherine B., Assistant Bacteriologist
Leland, Stanley E., Professor
McCollum, William H., Professor
Mangelsen, Dorothea J., Assistant in Animal Pathology. Resigned 1/3/61
Mochow, Marion S., Assistant in Animal Pathology. Effective 7/1/60
Ridley, Robert K., Assistant in Animal Pathology. Resigned 8/31/60
Rooney, James R., Professor. Effective 11/1/60
Shepard, Barbara P., Assistant Professor
Wyant, Zae W., Technician
Szanto, Joseph, Assistant Professor. Effective 1/23/61

CREAMERY LICENSE

Williamson, Glynn E., In Charge of Creamery License Section
Brown, Joe B., Inspector
Cox, Ben W., Technician
Foster, James D., Inspector. Deceased 12/11/60
Whitehead, Samuel D., Inspector

DAIRY SCIENCE

Seath, Dwight M., Head of Department and Professor of Dairying
Bucy, John L., Laboratory Technician
Freeman, T. R., Professor of Dairying
Glenn, Wilburn E., Assistant Professor
Graden, Arthur P., Instructor
Jacobson, Don R., Associate Professor
Miller, William M., Instructor
Olds, Durward, Professor
Rudnick, Arthur Jr., Assistant Professor
Walton, Robert E., Assistant Professor

ENTOMOLOGY AND BOTANY

Townsend, L. H., Department Head and Professor of Agricultural Entomology
Baugh, Lucy, Seed Analyst
Deen, Encil, Seed Technologist
Hensley, Claude, Nursery and Seed Inspector
Knapp, Fred W., Assistant Professor. Effective 6/1/61
Morton, Margaret, Seed Analyst
McDaniel, Alice, Seed Analyst
Rodriguez, J. G., Associate Professor
Starks, Kenneth, Assistant Professor. Resigned 6/3/61
Thurston, Richard, Associate Professor
Tilson, Howard G., State Entomologist
Todd, Anne F., Seed Analyst
Wiles, Mabel, Seed Analyst

FEED AND FERTILIZER

Poundstone, Bruce, Head of Department
Adair, John T., Assistant Chemist
Allen, Harry, Chief Chemist
Caudill, Paul R., Chemist
Daugherty, David M., Inspector of Registration. Resigned 7/1/61
Davis, Maurice M., Assistant Inspector
Dawson, Jo Ann, Assistant Chemist. Resigned 8/1/60
Ellis, John H., Assistant Chemist
Gault, Lela H., Assistant Chemist
Holbrook, Norma M., Assistant Chemist
Howard, N. J., Inspector
Huffman, Wilfred, Registration Inspector
Hulette, Neville, Feed Inspector
Mathews, Robert, Chief Inspector and Administrative Assistant
Midkiff, Valva, Chemist
Newman, Dewey H., Jr., Assistant Chemist
Price, Robert N., Assistant Chemist
Routt, Wilson, Assistant Inspector
Shrader, J. A., Microscopist
Terrell, Harris W., Jr., Associate Chemist. Resigned 8/22/60
Wheeler, Otis R., Assistant Inspector
Zichefoose, Guy, Auditor and Inspector

HOME ECONOMICS

Marlatt, Abby L., Director of School of Home Economics and Professor of Home Economics
Boyden, Ruth, Assistant Professor
Erickson, Statie, Distinguished Professor of Home Economics
Hallmark, Elizabeth L., Assistant in Home Economics. Effective 3/7/61
Marshall, Helen R., Associate Professor. Resigned 9/19/60
Skerski, Gertrude M., Assistant Professor
Wells, Claudia E., Assistant Professor
Wightman, Mildred R., Assistant Professor

HORTICULTURE

Chaplin, Carl E., Associate Professor and Acting Head of Department
Schneider, G. W., Head of Department. Transferred to Agricultural Extension, 10/1/60
Abernathie, Jan W., Assistant Professor
Armstrong, W. D., Horticulturist
Cotter, Donald J., Assistant Professor
Davenport, O. M., Professor
Emmert, E. M., Professor
Herron, James, Associate Professor
Kelley, James D., Assistant Professor
Knavel, Dean E., Assistant Professor
Martin, Dudley C., Assistant Professor
Murphy, Sallie B., Technician
Waltman, C. S., Professor

POULTRY SCIENCE

Insko, Wyatt Marion, Jr., Head of Department and Professor of Poultry
Abbott, Okra, Jr., Associate Professor
Begin, John J., Assistant Professor
Johnson, Thomas H., Assistant in Poultry
MacLaury, Donald W., Professor
Tuttle, John W., Field Agent in Poultry Improvement
White, John C., Assistant Professor

PUBLIC INFORMATION

Smith, J. Allan, Department Head and Professor of Public Information and Educational Aids
Duncan, Joseph G., Associate Professor
Hagan, Sara M., Editorial Assistant

ROBINSON SUBSTATION

Derrickson, C. M., Superintendent
Noble, Milton, Forester

RURAL SOCIOLOGY

Coleman, Amos L., Department Head and Professor of Rural Sociology
Ford, Thomas R., Professor
Brown, James S., Associate Professor
Coughenour, Charles M., Associate Professor
George A. Hillery, Assistant Professor. Effective 7/1/66
Pearsall, Marian, Associate Professor. Transferred to Medical Center 7/1/60
Schwarzweller, Harry K., Assistant Professor

WESTERN KENTUCKY SUBSTATION

Lowry, S. J., Superintendent
Caldwell, L. M., Assistant Superintendent
Overfield, James R., Assistant in Animal Husbandry

RESULTS OF RESEARCH IN 1961

by the

Kentucky Agricultural Experiment Station

THE PURPOSE of this report is to put on record the general scope of work and some of the principal findings of the various active projects of the Kentucky Agricultural Experiment Station in 1961. As most of the findings are for one year only, they may be incomplete or inconclusive unless viewed in relation to the findings of other years —in the past or still to come.

AGRICULTURAL ECONOMICS

Chain store requirements for fresh egg suppliers.— Chain store buyers are striving to develop a more concentrated supply structure. At the present time, minimum purchase requirements range from 100 to 200 cases per week from a single supplier. The majority of the chains are using 200 cases per week as their minimum requirement. Presently, 65 to 70 percent of the eggs handled by chain food stores are Grade A large eggs.

Kentucky suppliers are not meeting minimum volume and quantity requirements. The failure to do so is due to small-scale producing units and the lack of concentration of these units.

Chain stores are following a general policy of direct procurement in order to obtain certain buying and merchandising efficiencies. Specification buying from specialized producing areas is the most desirable practice from the standpoint of the grocery chains. Chain buyers are continually seeking suppliers who have volume and quality capability.

Approximately 70 percent of the fresh eggs handled by chain food stores in Kentucky are purchased outside of the state. Most of these eggs are purchased from midwestern states, with the majority coming from Indiana. One chain is purchasing around 90 percent of its egg supply from Minnesota.— Donald Shadoan.

Cost of operating looseleaf auction warehouses.— A study of the efficiency problems in operating looseleaf tobacco warehouses was undertaken by the Kentucky Experiment Station in 1960. The highly seasonal character of the auction sale service makes it exceedingly difficult to utilize efficiency methods of operation found in other systems of marketing. Hand labor used in tobacco warehouses accounts for around 65 percent of the total operating costs. The opportunity to reduce these costs through mechanization is lessened due to an operating period of only 5 to 10 weeks. The short seasonal nature of the operation, likewise, creates difficult problems of gaining adequate returns and efficient utilization of a relatively heavy capital investment in warehouse facilities. Adequate returns for investment

rest heavily on securing and moving a heavy volume of leaf through a warehouse in the short sale season.

An operating cost of serious importance to warehousemen is that of short-weight deductions on the part of buying organizations. These deductions, which become losses to warehousemen, have increased in amount in recent years. Much of the loss in weight is credited to moisture changes occurring in the tobacco between the time of weighing in at the warehouse and of delivery to the buyer's plant. The amount of moisture change likely to occur is believed to be associated largely with the climatic conditions at the time of preparation and delivery to market and the type of warehouse construction. The greater weight losses have been observed in warehouses having concrete floors and in the first and second sale of the market season. These tobaccos are stored on the floors for a much longer period than tobacco delivered during the rest of the sale season.— Carl M. Clark.

Management and labor crew utilization contributed to a successful snap-bean operation in south Kentucky.— A snap-bean enterprise has operated for four years in Pulaski and Wayne counties. The enterprise is one of the most successful in recent years. The success can be attributed largely to two factors: (1) over-all planning by management which concentrated acreage, selected farmers, staggered planting, supervised cultural and spray programs, supervised harvesting, and marketed the beans; and (2) a well-coordinated labor supply for harvesting, provided by excellent cooperation of farmers, labor crew leaders and crew members with the U.S. Employment Service Office. Part-time truckers in surplus labor communities assembled and transported picking crews to farms. USES maintained daily contact during harvest between farmers requiring labor and truckers supplying labor. The truckers or "crew leaders" were responsible for and supervised the members of their crews at the farms. The crew leaders and workers were remunerated in relation to the volume of beans harvested. — Willard H. Minton.

Work methods influence labor requirements and returns in pickle production.— Training of vines, flopping of vines before picking, returning vines, and searching for overlooked pickles resulted in the best returns on the average for the past two years. (1) Untrained vines that were searched and picked in place required 158 man hours per acre to pick and grossed $298 per acre. (2) Vines trained parallel with the row, each half of the row flopped over the other half of the row, picked, and returned to place required 166 man hours peracre and returned $282 an acre. (3) Searching the vines, after the flopped half of the row was replaced, for pickles overlooked in picking the upturned vines increased the labor to 186 man hours required to pick an acre but increased the return to $395 an acre. Hence, the methods returned a gross of $1.88, $1.70 and $2.08 per hours of picking time respectively. —George B. Byers.

State institutional farm study.— A linear programming analysis of the institutional farms in Kentucky revealed that considerable savings were possible in the food-production program by allowing farms to specialize in the production of products to which their resources were best suited and receive the balance of their food requirements from other farms. Specialization would require the movement of products and resources among institutions, which in turn would necessitate a central decision-making unit to coordinate activities within the institutional farm system.

It is estimated that the proposed farm program would produce food products valued at nearly $2 million per year at wholesale prices. Implementation of the program would require an initial capital outlay of about $1.2 million and an annual cost of slightly over $1 million to keep the program in operation.— John G. Stovall.

Dairy mergers and expanding market trends.— Fewer and larger firms characterize the bottling and sale of fresh milk products in Kentucky. Ten percent of the plants made about 60 percent of the bottled sales in 1960, and 13 processing centers supplied 90 percent of the fluid products. Since 1952, 50 milk bottling firms have sold, merged with other plants, or discontinued in the milk business. The average volume graded milk received by the 73 remaining plants increased by about 60 percent. The growth of national and regional dairy marketing firms; the trends toward specialization in processing; and the high mobility in bulk farm and over-the-road tank trucks are factors bringing about numerous consolidations.

Research on distribution shows a fanning out of routes from primary processing centers. Sales are made at distances in excess of 200 miles from the point of processing. Older concepts of local markets and local supply sources have given way to complex and extensive marketing and supply areas. Confronted by these problems, four dairy marketing cooperatives have merged into a single organization of about 3,000 members.

Specialization in both farm production and processing plant operations are important trends. New competitive marketing structures and complex pricing problems are emerging as the result of technological changes in the dairy industry. More mergers and consolidations appear in prospect.— John B. Roberts.

A comparison of working wives with nonworking wives in food shopping and preparation attitudes and practices.—(In cooperation with Home Economics Department; see page 52.)

Relative cut-out percentages and values of light and heavier weight hogs.— (In cooperation with Animal Husbandry Department; see page 32.)

AGRICULTURAL ENGINEERING

Curing primed burley leaves and whole plants in loose bulks.— Bulk temperatures, air static pressures, air flow, weight lost with

time, bulk density, fuel consumption, and suitability of the cured products were determined for loose bulks of primed leaves as well as whole plants.

The primed leaves yellowed rapidly under conditions of high air flow rates (100 ft/min) and high drying potential (90°F dry bulb and 65°F wet bulb). At the end of 48 hours in the pile, the primed leaves had yellowed completely. The bulk-cured samples were adjudged off-type as compared to an air-cured check sample because of too rapid drying as shown by their yellow color.

Whole plants were placed (without clamping or spearing) into bins 3′ high by 4′ wide by 6′ long. The initial bulk density was about 12 lb/ft^3 or 14 plants (5′ long) per ft.^{2}. This is a space saving over the conventional air-curing barn by a ratio of 7 to 1. Tip leaves had yellowed completely in 4 days. Supplemental heat and forced ventilation with air temperatures up to 170°F were used during the next 6 days of drying. The bulk-cured tobacco showed a slight pressed appearance as compared to normal air-cured samples, but was not adjudged off-type by the government graders.— W. H. Henson.

Progress in the development of a mechanical tobacco harvester.— With the design and development of a completely automatic burley tobacco harvester as an objective, the Agricultural Engineering Department, in cooperation with Mr. J. W. Walden, completed the building of the basic machine which was begun in 1960.

The machine has been built in four components—a cutting unit, a spearing unit, a stalk-spacing stick-filling unit, and a stick-dispensing unit—each of which is designed to meet its specific functional requirements in the harvesting process.

The first of these units was completed and added to the other three which were built and laboratory tested last year. These four hydraulically-driven and controlled components were placed within a frame and suspended from an altered high-clearance tractor.

Limited field tests were conducted after the machine had been laboratory tested, including high speed photographing of various mechanical movements for future analysis.

These tests indicate that with the elimination of minor difficulties the machine will meet its design capacity of six sticks (on which 6 stalks are evenly spaced) per minute.— S. W. Smith.

Plastic mulching use in field seeding tobacco.— Five techniques to control seedbed environment for field-seeded tobacco were observed. Even though some of these gave a high percentage weed control, none proved successful, since none gave the needed 100 percent weed control. — J. M. Bunn.

Spectrophotometer analysis of tobacco curing.— Stalk tobacco and tobacco in which the leaves were removed from the stalk and then tied back to the stalk with strings were cured in bulk and conventionally. The leaf's ability to absorb, transmit, and reflect visible light was recorded at 2-day intervals throughout the cures. These

data are being analyzed to determine if leaf response to visible light is related to the dynamics of the curing process and/or the final condition of the cured tobacco.— J. M. Bunn.

Physical properties of burley tobacco.— An investigation was continued to determine and define in engineering terms the physical dimensions of mature burley tobacco plants. Data were collected on the following, taper of stalk, location of leaves, leaf dimensions, moisture content of stalk, weight of stalk, and weight of leaves.

Plans are being made to study strength properties of mature stalks during the 1962 season. Properties to be determined include modulus of elasticity and cleavage (force required to progress a split in the stalk). This information will permit the prediction of length of a split due to spearing and may be used in solving other problems encountered in designing machines to harvest and handle burley tobacco. — J. H. Casada.

Outside curing of burley tobacco under plastic.— One acre of burley tobacco was field cured on curing frames covered with polyethylene plastic film and one acre was cured in the conventional barn. The curing frames were so constructed that they could be handled with a fork lift to save labor. The tobacco cured under plastic averaged $68.11 per 100 pounds and the tobacco cured in the conventional barn averaged $68.24 per 100 pounds.— E. M. Smith.

Flame cultivation.— Flame cultivation resulted in satisfactory control of weeds and grasses in corn. Sweep or mechanical cultivation in the same field was unsatisfactory. Flame cultivation of tobacco resulted in good weed control but reduced the growth rate of the tobacco.— E. M. Smith.

Bulk curing of primed burley.— Preliminary observations were made on a commercial bulk-curing barn to examine the possibility of adapting this system for curing primed burley tobacco. The installation was located on the farm of Mr. J. D. Gay, Jr., Pine Grove, Kentucky. The system shows a good deal of promise as a method of curing primed burley if certain problems can be solved, namely: (1) control of bacterial rot; (2) improved air distribution to obtain the characteristic burley color with relatively high-moisture air; (3) improved racks for holding the tobacco in the curing barn; and (4) modified rail spacing to accommodate long burley leaves.—E. M. Smith.

Plastic greenhouse heating and ventilating.— A system for automatically controlling the temperature within greenhouses in both summer and winter was designed and installed in a horticultural greenhouse. The system consists of a continuously running fan capable of providing one air change per hour, a forced hot-air furnace, and dampers and controls. The dampers are opened by a temperature-modulated motor so that the fan pulls outside air into the greenhouse when cooling is required. At other times the fan recirculates air in the greenhouse. The system eliminates the need

for vents in the house and appears to greatly reduce humidity problems. The system has performed as designed and has been successfully installed in a commercial operation. Plans describing the above system are being prepared.— J. N. Walker.

Environmental design features of livestock and poultry shelters.— Thermal radiation from the underside of 15 types of roofs was measured and analysis is now in progress to determine whether significant differences existed among the roof types tested. This work was a continuation of the roof studies conducted during 1958-1960 and was undertaken to provide more extensive data on roofs covered with conventional roofing materials. Eight new types of roofing materials were tested for the first time in 1961. The data collected show that painting a roofing material white effectively reduces the temperature of roofing material when it is exposed to sunlight. The influence of various roofing materials on the environment within either enclosed structures or open-front structures will be predictable from the data collected in this study.— B. F. Parker.

AGRONOMY

Climatological station established.— A rather complete climatological station was put into operation March 1, 1961 on the Experiment Station farm at Lexington. The main emphasis of the station is on the microclimate. Data are recorded on precipitation, air and soil temperatures, soil moisture, humidity, wind, and evaporation. Precipitation occurred on 134 days in 1961 and the total amount was 48.22 inches, which was 4.51 inches more than the long-time average. The distribution of precipitation during the growing season was quite uneven; for example, 8.39 inches of rain fell in July and 0.88 inches in September. Based on the long time average, March through July was wetter than normal and August through October was dryer than usual. The spring and early summer was cooler than usual with frost occurring on April 11, 14, and 20th and on May 3 and 26th.— T. H. Taylor, J. M. England, J. K. Evans, and W. C. Templeton, Jr.

Potassium uptake by excised roots of burley tobacco.— The absorption of potassium by excised roots of Experimental 4, a low K uptake variety, and Burley 21, a medium K uptake variety, was studied. Burley 21 absorbed 30% to 40% more K from KCl over 3-to 4-hour periods than Experimental 4. The absorption process was shown to involve two different mechanisms in both varieties. One mechanism is more important when roots are absorbing K from solutions of low K concentrations and the other is more important when absorbing from solutions of high K concentrations. Respiration measurements showed no significant differences in total respiration between varieties. Potassium uptake by both varieties is greater from solutions of KCl than from solutions of $KHCO_3$. Evidence suggests that the uptake mechanism which operates at high KCl concentra-

tions is the same for both varieties, but the other mechanism may be different in the two varieties.— A. J. Hiatt.

Condensing enzyme from tobacco plants.— Condensing enzyme, which catalyzes the condensation of oxalacetic acid and acetic acid to produce citric acid, was disovered in tobacco leaves and roots and the enzyme was obtained in soluble form. This enzyme had not been identified previously in plants. This reaction is the point of entry of carbohydrates into the citric acid cycle which oxidizes organic acids to produce energy required by the plant. The enzyme was purified and its properties were studied.— A. J. Hiatt.

Studies of calcium deficiency in burley tobacco.— Analysis of burley tobacco varieties which are readily susceptible to Ca deficiency showed that Ca deficient plants did not have a lower Ca concentration than did varieties which show no Ca deficiency. Calcium deficient plants generally had higher oxalic acid concentrations in the bud and youngest leaves than did non-deficient plants. This evidence suggests that calcium deficiency is induced by the precipitation of Ca within the cell as calcium oxalate, thereby rendering the Ca unavailable for use by the expanding cells.— A. J. Hiatt.

Manganese toxicity of burley tobacco plants grown in nutrient solutions.— It was verified by solution cultures in the greenhouse that excess manganese is responsible for the symptoms commonly referred to as "manganese toxicity" of tobacco. Manganeze toxicity symptoms were apparent in leaves containing approximately 2,500 ppm manganese. This concentration resulted when the tobacco plants were growing in nutrient solutions containing 20 ppm Mn and 0.5 ppm chelated iron. When the concentration of iron chelate in the nutrient solution was increased to 10 ppm, symptoms of Mn toxicity did not appear until the nutrient solution contained 60 ppm Mn. This suggests that Mn toxicity is to some degree a disruption of the normal iron nutrition of the plant. Aluminum, at equal concentrations in the nutrient solution, caused many fold greater reductions in growth of tobacco plants than Mn but produced no easily distinguishable plant symptoms. The possibility that soluble aluminum in very acid solids is contributing to the poor growth of tobacco plants suffering Mn toxicity is being considered.— A. J. Hiatt and John L. Ragland.

Black root rot of Japanese holly.— A culture of *Thielaviopsis basicola*, isolated from the roots of *Ilex crenata*, appeared morphologically identical to tobacco cultures. Tests indicate that the holly isolant is pathogenic on holly but not to tobacco. The tobacco isolants tested appear not to be pathogenic on holly.— E. M. Johnson and R. A. Chapman.

Most prevalent diseases of tobacco in 1961.— Manganese toxicity of tobacco, which usually occurs on soils where the pH is below 5, was very prevalent throughout the state. Another disease of tobacco,

organic matter toxicity, induced by a toxin resulting when organic matter decays slowly, was also prevalent in tobacco fields. Both of these diseases are rarely present in tobacco following grass sods. Black shank, *Phytophthora parasitica* var. *nicotianae*, previously more prevalent on smaller farms in overflow stream areas, has now appeared on many large farms in areas not subject to overflow. No good explanation for the appearance of black shank on larger farms can be given. Angular leaf spot, *Pseudomonas angulata*, or rust, a bacterial disease closely related to wildfire, after an almost complete absence of several years, is now becoming of increasing importance. Wildfire resistant burley, including Burley 21, appear not to be resistant to angular leaf spot.— E. M. Johnson and R. A. Chapman.

Survey of noncultivated soils of the state for Thielaviopsis basicola. — *T. basicola* was isolated by the carrot disk technique from 23 of 31 samples from 14 different locations in the state. Pathogenicity tests of some of these isolates are being made to Atlantic alfalfa, Kenland red clover, Rowan lespedeza, Borrie Sweet Blue Lupine, and three varieties of tobacco.— Lawrence Henson, G. W. Stokes, and C. C. Litton.

Reaction of seedlings of annual lespedeza varieties to tobacco isolates of Thielaviopsis basicola.— In controlled greenhouse tests, Auburn, Arkansas 10, Iowa 6, Climax, and Rowan were susceptible. Commercial Korean and Kobe were also susceptible. Small differences in the reaction of the individual plants suggest that selection for resistance would not be successful.— Lawrence Henson and G. W. Stokes.

Maintenance of quantity and quality of Thielaviopsis basicola on various crops.— A field experiment to study the effect of alfalfa, birdsfoot trefoil, sweet clover, red and white clovers, lespedeza, vetch, bluegrass, and three varieties of tobacco on the maintenance of the quantity and quality of *T. basicola* was begun in September, 1961. A black root rot susceptible variety of tobacco, Ky 151, grown on this area was uniformly and severely injured by this disease in 1961. *T. basicola* grew from this soil on 308 or 88% of 350 carrot disks.— Lawrence Henson, G. W. Stokes, and C. C. Litton.

Comparisons between Experimental 12 and Burley 21 when different rates of potash fertilizer was used and some of the effects of these rates of fertilizer on each variety.— At Campbellsville in 1961 both Burley 21 and Experimental 12 were grown on each of the following potash treatments: 60, 120, 180, 240, and 720 lb per acre. The first four treatments each received 80 lb N and 160 lb of P_2O_5; the fifth treatment received 120 lb N and 360 lb P_2O_5. From each treatment 12 plants from each variety were taken for samples and each plant analyzed separately. The concentrations of K, N, P, Ca, Mg, Mn, and total alkaloids were determined in the leaf tissue, midrib, stalk, tops, and suckers, and calculated for the entire leaf and the total above-ground part of the plant.

The yield of Experimental 12 was greater than Burley 21 when

120 or more lb of potash per acre was used and less than Burley 21 when less potash was used. The greatest difference between varieties in either case was at the extremes. As the rates of potash increased the yield of Experimental 12 gave a linear increase. The yield of Burley 21 increased only at the two highest rates, but increases there were not as great as for Experimental 12.

The difference between Experimental 12 and Burley 21 in uptake of potassium for the total plant was very similar to the weight difference between the varieties; that is, when more than 120 lb of potash per acre was used the uptake of potassium was greater by Experimental 12 than by Burley 21 and when less than 120 lb was used uptake was greater by Burley 21. At the highest rate of applied potash the increase in uptake was greater than the increase in weight, so that the concentration of potassium in the plant was greater in Experimental 12 than in Burley 21. At the lowest rate this was reversed, so that the concentration was lower in Experimental 12 than in Burley 21. At the 120, 180, and 240 lb rates there was very little difference between the two varieties in the concentration of potassium.

The concentration of potassium varied considerably between the different parts of the plant. Generally the midribs had the highest concentrations and the stalks the lowest. Rates of applied potash affected the concentration in the various parts of the plant differently. The concentration in the midribs increased from 1.34% to 10.72% in Experimental 12 when the rate of applied potash was increased from 60 to 720 lb per acre. The tops from the same plants increased from 2.59% to 4.22%. All of these changes were greater in Experimental 12 than in Burley 21.

When nitrogen treatments were the same, potash fertilization had no effect on nitrogen uptake by Burley 21, but increased potash fertilization resulted in increased nitrogen uptake by Experimental 12. Because of differential yield response, there was little difference between varieties in the concentration of nitrogen; however, both varieties decreased in nitrogen concentration with increased potash fertilization.

The effects of increasing rates of potash on the uptake of phosphorus by each variety were very similar to the effect on uptake of nitrogen; that is, no effect on Burley 21 but some increase in Experimental 12. The effects of rates of potash on uptake of phosphorus were not as great as the effects on weight, so that the concentration in both varieties decreased as the rates of applied potash were increased. The percent of the total plant phosphorus decreased in the leaf and increased in the stalk with increased potash fertilization. The highest concentration of phosphorus was in the suckers in both varieties and the lowest in the stalks.

The uptake of Ca and Mg decreased in Burley 21 as the rates of applied potash increased. In Experimental 12 there was no increase in calcium uptake above the 120 lb potash treatment and very little increase in magnesium uptake. The concentration of Ca and Mg in both varieties decreased as the rates of applied potash

increased, but was greater in Experimental 12 than in Burley 21. About three-fourth of the Ca and three-fifths of the Mg in the above-ground part of the plants was contained in the leaf.— J. L. Hamilton, C. E. Bortner, and W. O. Atkinson.

Greenhouse Liming Experiment.— Burley tobacco was grown in the greenhouse in unlimed Dickson silt loam soil from the Campbellsville Soil Experiment Field. Calcium and magnesium carbonates were added to the soil in equivalent ratios of 1:1, 5:1, 10:1, 20:1, and calcium carbonate alone, at equivalent rates of 0, 1, 2, 4, and 8 tons per acre.

Yields tended to increase from all ratios as "liming" materials were increased up to the 4-ton level, but decreased at the higher level. Calcium carbonate alone at the two higher levels induced magnesium deficiency in the plants during early growth. Although at the time of harvest (eight weeks after transplanting), yields from all except the 8-ton treatment were higher from the plots receiving a Ca/Mg ratio of 1:1, severe bud injury from the 4-ton 1:1 treatment, as well as all 8-ton treatments, had developed to the extent that yield results would no doubt have been altered had the growth period been extended.— A. M. Wallace.

Wildfire and angular leaf-spot in a wildfire resistant burley tobacco.— For the past several years crops of Burley 21 have been seen heavily infected with angular leaf-spot (*Pseudomonas angulata*). This year a bed of Burley 21 heavily infected with wildfire (*P. tabaci*) was seen near Lexington. The organism isolated from the bed and later from heavily infected tobacco in the field caused typical infection on the resistant varieties Burley 21 and Experimental 12 at high dilutions, and caused typical wildfire on *N. longiflora* which is resistant to ordinary field strains of the wildfire organism.— W. D. Valleau, C. C. Litton, and E. M. Johnson.

First generation hybrids of burley tobacco.— In the course of the breeding work on burley tobacco, male-sterile burley tobaccos have been developed carrying the cytoplasm of *Nicotiana debneyi* Domin. or *N. suaveolens Lehm.* but a full complement of *N. tabacum* chromosomes. The former develops flowers with a split tube and rarely set seed when cross-pollinated in the field, but will set in the greenhouse. The latter develops flowers with a normal tube and set seed readily in the field when cross-pollinated. By backcrossing on male-sterile any variety may be made male-sterile and used as the female parent in making first-generation crosses with normal varieties. The *N. suaveolens* type of male-sterile burley is being used in the production of first-generation hybrids by two commercial seedsmen.— W. D. Valleau and G. W. Stokes.

Comparison of potassium uptake and utilization by two varieties of burley tobacco.— The uptake of potassium from a Maury silt loam soil at bulk densities of 1.0 to 1.4 by Burley 37 was not significantly different than the uptake of this element by the variety known as

Experimental 4 at these degrees of compactness. However, Burley 37 appeared to utilize the absorbed potassium more efficiently than Experimental 4 since Experimental 4 showed potassium deficiency symptoms even though containing approximately equal percentage of potassium in the tissue of its roots and leaves.

Manganese uptake was greater in both varieties grown in soil of higher bulk densities than when these same varieties were grown in the less compact soil.—W. G. Survant.

Comparison of two alfalfa varieties.— Vernal and FD-100 alfalfa varieties were planted at Lexington in September 1960, on a moderately drained lowland site and on a well-drained upland site. The crop was harvested 3 times during the growing season of 1961. FD-100 was higher yielding than Vernal at both sites.— T. H. Taylor, W. C. Templeton, Jr., and J. M. England.

Management studies on creeping-type alfalfa.— Parental and F_1 plants of crosses of several clones of non-creeping alfalfa varieties with a creeping clone from the variety Rambler were clonally propagated in the greenhouse and transplanted to the field in early May 1961.

Shoot counts and yield data indicate that the F_1 plants were equal or superior to the parents in yield and number of shoots per plant. During October 1961, shoot development from lateral roots (creeping) was observed on each of the F_1 plants.— T. H. Taylor, W. C. Templeton, Jr., N. L. Taylor, and J. M. England.

Tall fescue strain evaluation.— Three tall fescues (Ky 31, 45-50, Ky Synthetic 2) and Boone orchardgrass were sown alone and in association with Ladino white clover in September 1960 and observed through the growing season of 1961. The grasses growing alone were fertilized with 200 pounds of N per acre applied in four separate 50-pound applications during the 1961 growing season. Yield and botanical composition data show that: (1) the total herbage yields (4 harvests) were not statistically different for the array of treatments, indicating that Ladino white clover made a considerable contribution to the yield of the grass-clover swards; (2) the yield in pounds per acre of the grass component of the nitrogen fertilized treatments were: Ky 31, 6,839; 45-50, 6,573; Ky Syn. 2, 6,247; and in the grass-clover swards 2,209, 1,878, and 1,825, respectively.— T. H. Taylor, W. C. Templeton, Jr., and J. M. England.

Effect of cutting frequency of Clair timothy.— Data were obtained the third productive year of this experiment. These data indicate that (1) plants cut 3 times per growing season resulted in higher yields and lower weed content in the hay than plants cut 4, 5, 6, or 7 times per season, but hay quality was poor the first harvest of the 3-cut system because the grass was overmature; (2) corm weights were highest on plants which were permitted to approach seed maturity before the first cutting and lowest on plants which were cut at 2- or 3-week intervals prior to the corm sampling date (June 22);

(3) plant survival was as high when the first cutting was made at the late boot stage (4 cuts per season) as at the seed stage (3 cuts per season). Frequent cutting during spring reduced stands and corm size.— J. K. Evans, T. H. Taylor, and W. C. Templeton, Jr.

Forage species.— Several species of plants were seeded during late summer 1960 and spring 1961 and were observed concerning time and amount of production. Field bromegrass (B. arvensis), Italian ryegrass, and Balbo rye were approximately equal in total production, but rye was more productive during the fall. Field bromegrass and ryegrass grew later into the spring than did rye. No species or mixture of species produced more dry matter than was obtained from orchardgrass-Ladino clover (7,763 pounds dry matter per acre). Midland Bermudagrass fertilized with 200 pounds nitrogen per acre produced 9,027 pounds and 6,715 pounds dry matter per acre when managed as meadow and pasture, respectively.— W. C. Templeton, Jr., T. H. Taylor, J. M. England, and J. K. Evans.

Alfalfa variety mixture management study.— Data were obtained the third productive year (1961) of this experiment. These data indicate that: (1) the variety DuPuits was higher yielding than Narragansett and that Rhizoma and Narragansett were approximately the same in yield; (2) the three varieties behaved approximately the same under the 3-, 4-, 5-, and 6-cut systems; (3) hay yields were the same on the 3- and 4-cut systems and considerably higher than under the 5- and 6-cut systems; (4) hay fields were the same on stands of alfalfa-orchardgrass and alfalfa grown alone but weed content in the hay was much higher in the alfalfa-sown-alone sward; and (5) stands of alfalfa deteriorated on the 5- and 6-cut managements.— T. H. Taylor, W. C. Templeton, Jr., J. K. Evans, and J. M. England.

Timothy vs. orchardgrass for dairy pasture.— In cooperation with Dairy Science Department; see page 43.)

Production of creeping-rooted plants from F_1 crosses of creeping x noncreeping alfalfa clones.— Six creeping-rooted alfalfa clones related to the variety Rambler were crossed with each of six clones in each of the varieties Narraganset, Vernal, Atlantic, and Rhizoma. These crosses produced 14.4, 16.8, 19.5, and 27.6% creeping plants, respectively, and an average of 19%, after 36 months in bluegrass sod. First creeping was noted 12 months after seedlings were transplanted. Percent creeping of F_1 plants from the six female parents in each variety ranged from 8.4 to 24.3 in Narragansett, 12.1 to 53.1 in Vernal, 0 to 28.0 in Atlantic, and 12.6 to 46.7 in Rhizoma. Percent creeping of F_1 plants from six creeping clones used as male parents ranged from 2.7 to 34.4. Among the parental clones, 34.4% of the Rambler-related plants, and no plants of the other varieties were creeping in sod after 36 months. Self progenies of creeping clones were creeping less than parental clones, indicating a possible relationship of the creeping phenomenon with vigor. Correlations of degree of creeping with erect growth habit ranged from .241** in

Narragansett x creeping to .424** in Vernal x creeping F_1 crosses. Correlations of degree of creeping with vigor ranged from .125* in Rhizoma x creeping to .544** in Atlantic x creeping F_1 crosses.— N. L. Taylor, W. H. Stroube, and G. W. Hicks.

Evaluation of the hybrid Trifolium pratense x T. diffusum.— In agronomic evaluation of amphidiploid *Trifolium pratense* x *T. diffusum* as a winter annual, tests at six locations throughout southeastern United States showed that open-pollinated seed of F_2 and F_3 lines of the hybrid were less vigorous than either parent, but approached more closely *T. diffusum*, which was considerably less vigorous than *T.pratense* (Kenland) and *T.incarnatum* (Kentucky Selection). Date of flowering was intermediate between the parents but was closer to 4n *T.pratense* (R-28) than to 4n *T.diffusum*. 4n *T. diffusum* and 2n *T.pratense* (Kenland) were about three to four days later than 2n *T.diffusum*.

The amphidiploid hybrid was about equally nodulated by strains of Rhizobium effective on *T.pratense* and by strains effective on *T.diffusum*. All strains nodulated both *T.pratense* and *T.diffusum*, but based on seedling color and size, strains from one parental species were more effective on that species than on the other. Considerable variation in strains existed. One sample of red clover-alfalfa commercial inoculant was about equally effective on the hybrid and *T.diffusum* but was somewhat more effective on *T.pratense*.

Examination of root tips of the hybrid *T.pratense* x *T.diffusum* and its parents showed the following 2n chromosome *T.pratense* (R-28),[28]; *T.pratense* (Kenland), 14; 2n *T.diffusum*, 16; 4n *T.diffusum* 32; diploid hybrid, 15; and amphidiploid, 30.— N. L. Taylor, W. H. Stroube, W. A. Kendall, and G. W. Hicks. (In cooperation with ARS.)

Spray programs for eradicating wild garlic.— Three years of spraying wild garlic in both early spring and late fall were required to eradicate the stand even where the ester form of 2,4-D was applied each time at rates of 3 or 4 pounds per acre. Applying at the same rates in early spring only required 4 years for eradication, and at 2 pounds, the rate commonly recommended, 5 years. Either maleic hydrazide used at rate of 4 lb or 2,3-6-TBA at 4 lb gave results similar to those obtained with 2,4-D at the 3 lb rate. The necessity for prolonged treatment even where all plants are killed each year by the heavy spray treatment is because some of the underground hardshell bulbs continue to sprout during the second and third years, as was revealed in parallel studies of bulb dormancy and activity.— J. F. Freeman.

Chemical weed control in soybeans.— Annual weeds in soybean rows were controlled 80 to 90 percent when rated 5 weeks after spraying the soil in a 13-inch band behind the planter press wheel at planting time with either of three herbicides at rates of active ingredient per acre as follows: Amiben, 4 lb; linuron, 1.5 lb; and CP 17029 (2,4-bis(3-methoxypropylamino)-6-methylthio-s-triazine), 2 lb. Only

amiben and linuron have label clearance, that for linuron being limited to use on soybeans grown for planting seed. Seventy to 80 percent weed control was obtained from the use of NPA, 4 lb; sodium PCP, 15 lb; or granular CDAA, 4 lb. The spray application of NPA and PCP performed about like their granular formulations but that for CDAA was much poorer than for its granular formulation. Another experimental material, Hercules 7531 1- 5-(3a, 4, 5, 6, 7, 7a-hexahydro-4, 7-methanoindanyl) -3, 3-dimethylurea 2 lb, also gave 70 to 80 percent weed control. None of these herbicide treatments reduced the yield of soybeans in comparison with the cultivated check.— J. F. Freeman.

Chemical weed control in corn.— Annual weeds in corn rows were controlled 95 percent or better for four weeks after spraying the soil in a 13-inch band behind the planter press wheel with either of several herbicides at rates of active ingredient per acre as follows: atrazine, 2 lb; simazine, 2 lb; linuron (3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea), 1.5 lb; CP17029 (2,4-bis(3-methoxypropylamino)-6-methylthio-s-triazine), 3 lb, all of them applied on the soil surface; and fenac, 1.5 lb; EPTC, 3 lb; or Tillam (propyl ethyl-n-butylthiolcarbamate), 6 lb, all lightly incorporated with the soil. The rows treated with atrazine, simazine, and linuron remained nearly free of weeds throughout the summer. Granular formulations of atrazine, simazine, EPTC, and Tillam resulted in weed control similar to that with the spray formulations. About 80 percent control of weeds resulted from use of the granular formulation of CDAA plus TCBC (Randox-T) 3.1 lb + 7.9 lb, whereas the spray formulation gave only 50 percent control. Seventy percent control resulted from use of either spray or granular applications of the ester of 2,4-D at rate of 2 lb, or spray application of 2.4-DEP (Falone) at 4 lb. None of these treatments controlled weeds after 6 to 8 weeks. Significant crop injury occurred from the fenac, EPTC, and Tillam treatments.

Directed post-emergence sprays with linuron 3 lb, when corn was 8 to 10 inches high and weeds were 3 inches high, controlled broadleaf weeds 100 percent and grasses 65 percent, without harm to the corn. The spray was directed to the weeds and beneath the corn leaves to avoid burning them. Residual action in the soil prevented seedling-weed-infestation throughout the summer. Several other herbicides used one week earlier had failed to control grass weeds although some of them gave good control of broadleaf weeds.— J. F. Freeman.

Small grain improvement.— Small grain variety tests were conducted at Lexington, Princeton, Murray (in cooperation with Murray State College), and at Bowling Green (in cooperation with Western Kentucky State College). Average bushel-per-acre yields at the four locations for the recommended varieties were: Wheat: Monon, 48.8; Knox, 45.6; Vermillion, 44.7; Dual, 42.4; Todd, 41.4; and Vigo. 39.7. Barley: Dayton, 61.5; Kenate, 58.6; Hudson, 58.1; and Kenbar, 55.1. Winter oats: Dubois, 76.1; Bronco, 72.4; Atlantic, 68.7; and Forkedeer,

66.8. Spring oats; Lexington location only: Mo. 0-205, 36.3; and Andrew, 35.2.

Investigation of the "bulk" breeding method for obtaining winterhardiness in oats is being continued. Seed of the F_5, F_7, F_9, F_{11} and F_{13} generations were saved from each of twenty "bulk" hybrid oat populations and are being screened at each of four locations for winterhardiness. Locations with an average January temperature 2, 4, and 6 degrees lower than Lexington were selected.

Seed supply of the barley variety C.I.10541 is being increased after reselection. The oat variety C.I.7132 is very susceptible to lodging but will be used as a source of breeding material for other desirable agronomic characteristics.— J. F. Shane and V. C. Finkner.

Grain sorghum.— Grain sorghum variety tests were conducted at Lexington and Princeton, and at Franklin in cooperation with Jernigan Bros. The test at Franklin was discarded because of a heavy infestation of foxtail. Average yields at Lexington and Princeton were 119.8 and 94.7 bushels per acre, respectively. Average yield for hybrids at the two locations was 114.2 bushels per acre, compared to 88.8 bushels for the standard varieties.— J. F. Shane and H. R. Richards.

Forage crop evaluation.— Red clover trials consisting of nine named varieties, four Kentucky-grown common lots, and seven experimental synthetics were conducted at six locations. Two-year yield data from one location showed that six of the synthetics were equal to Kenland, and that Kenland and four of the synthetics were superior to the common lots and to all the other named varieties tested. Persistence data from four locations showed that six of the synthetics were the only lines equal to Kenland in the spring of the third year after seeding.

Seven varieties of annual lespedeza produced an average of about 2.3 tons of hay per acre in 1961. The yields of these varieties were not significantly different. Some resistance to *Rhizoctonia* aerial blight was exhibited among the Korean varieties by Arkansas experimentals 10 and 31 cd.

Sweet clover varieties Denta and Evergreen produced more forage than other varieties in tests in 1961. Denta, a low coumarin variety, remained vegetative longer than the other varieties and proved to be a good seed producer.— W. H. Stroube, G. W. Hicks, and N. L. Taylor.

Mosaic in old burley tobacco.— In 1935 (Kentucky Bul. 361) we reported that tobacco mosaic could be transferred from tobacco grown in 1882, the year tobacco mosaic was first described. This year, after 79 years, the same tobacco was again tested by inoculating susceptible plants from each leaf separately. One hundred and twenty-three leaves were tested. Mosaic developed in two plants, but when the leaves from these plants were retested we failed to get mosaic. Thirty-five samples reported in Table 1 of Bul. 361 were retested but no mosaic developed in susceptible plants. The ground

samples had been kept in heavy paper envelopes the past 26 years.—W. D. Valleau and E. M. Johnson.

Physiological investigations of red clover.— Plants of red clover which were in a reproductive phase of growth were more susceptible to the root rot fungus (*Sclerotium bataticola*) than plants in a vegetative growth phase. It was not possible to isolate chemicals from the clover roots which could be demonstrated to inhibit growth of this fungus.—W. A. Kendall. (In cooperation with ARS.)

Intereffects of management practices and environment on stands of red clover.— Under controlled environmental conditions in the laboratories, plants of varieties and clones known to persist relatively well in fields in Kentucky flowered at a later date than plants of unadapted varieties and clones. These results support previous inferences that flower production is detrimental to persistence.—W. A. Kendall. (In cooperation with ARS.)

Effect of amount of light on development of a spiral nematode on Kenland red clover.— As the hours of light were increased growth of Kenland red clover increased, but the number of spiral nematodes (*Scutellonema boocki*) per gram of root decreased. From plants growing for 133 days under periods of 8, 12, 16, and 20 hours daily illumination were recovered, respectively, 265, 81, 8, and 7 nematodes per gram of root from 2.0, 5.2, 8.9, and 14.1 grams of roots. From plants growing for 114 days under periods of 5, 10, and 20 hours daily illumination were recovered, respectively, 2285, 455, and 412 nematodes per gram of root from 0.2, 3.3 and 4.9 grams of roots.— R. A. Chapman.

Effect of amount and location of calcium in the soil on its uptake by plants.— A bluegrass sod has been established on sixteen 5′ x 8′ x 12″ frames of soil transported to Lexington from the Greenville experiment field. The soil has received 4 different liming treatments. These plots will periodically receive Ca45 injections at various depths during the spring and summer of 1962. The grass clippings will be analyzed to determine the calcium feeding pattern of bluegrass grown on soil of widely differing lime status. This information will be useful in determining ways to lower plant uptake of strontium 90 since its uptake is reduced by high soil calcium in the soil zone where the strontium is present. Considerable information has also been gathered on the various chemical factors determining the movement of calcium in a soil profile.— J. L. Ragland and H. F. Massey.

Effect of fertilizers on solubility and availability to plants of other soil nutrients.— Phosphate and non-phosphate fertilizers were added separately and in combination to pots of soil. The soils were moistened, incubated, and the soil solutions extracted for chemical analysis. Fertilizer additions were quite high by whole soil standards but comparable to those found in fertilizer bands. The addition of non-phosphate fertilizers greatly increased the concentration of cations in

the soil solutions, but the phosphate fertilizers markedly reduced cation concentrations. The concentrations of iron, aluminum, manganese, and calcium were particularly affected. In addition to the major objective of the experiment, a great deal is being learned about what reaction products are forming at the fertilizer soil interface. This information is of interest to the TVA organization which is cooperating on the experiment. Addition of fertilizers to the soil at a rate of 1% by weight reduced emergence of corn in the order of potassium chloride greater than ammonium nitrate, greater than diammonium phosphate, greater than monoammonium phosphate, greater than concentrated superphosphate.—J. L. Ragland, H. F. Massey, and R. L. Miller.

Residual availability of superphosphate as affected by rate of application, placement, and soil reaction.— The experiment was established in the spring of 1959 with tall fescue on limed and unlimed plots at the Greenville experiment field. Band placements of concentrated superphosphate from 0-1000 lb A P_2O_5 and broadcast treatments of 125-3000 lb A were used. Generally, yield increases due to phosphorus were much smaller in 1961 than 1960, but yield increases due to liming were much greater than in 1960. The residual value of the phosphorus fertilizer was greatest for band placement on the limed plots but generally no different or greater for the broadcast placement on the unlimed soils. Phosphorus analysis of concentric 1-inch rings around the fertilizer bands indicate additional movement of phosphorus has occurred since last year, but the picture is complicated by reversion, since last year, of much of the added phosphorus to chemical forms that are not extracted by the phosphorus extraction solution.—John L. Ragland.

Effect of time on application of potassium fertilizers on yield of dry matter and on uptake of potassium by alfalfa and Ladino clover, and the distribution of exchangeable potassium in the soil profile.— Two experiments have been conducted over a period of three years: alfalfa on Maury silt loam, and Ladino clover on Grenada silt loam. Three rates of K (150, 300, and 450 lb per acre) were applied at different times relative to seeding: spring before seeding in the fall, fall at seeding time, and one third of each rate applied annually.

Dry matter measurements indicated that, when the three rates are considered as a whole, it makes little difference when the potassium is applied to the Maury soil for alfalfa or to the Grenada soil for Ladino clover as long as the total amount applied is equal to or more than 100 lb per acre per year. If no more than 50 lb K per acre per year was used, it was necessary to apply it annually to maintain yields equal to the higher rates applied either before or at seeding time or as annual applications. In essence the 50 lb K per acre applied as an annual application was the most economical rate for both species on the two soils if three years is as long as the crop is to be grown and longevity of stand is not important.

The potassium removed with the dry matter increased as the

amount of K applied was increased, and in all cases more was removed than was applied. The Maury soil was much more effective in fixing the applied potash against crop uptake when it was applied 2-3 months in advance of seeding than was the Grenada soil.

The downward movement of K in the soil profile as indicated by extractable K is very slow in the Maury. No increase in K below 3 inches was detected after almost three years, except in the plots which received 450 lb in the spring before seeding in the fall, where only a slight increase was detected in the 3-6 inch zone and none below 6 inches. The data from the Grenada profile samples are inconclusive, but there appeared to be a decrease from the surface to the 6 inch level and an increase with depth to the lowest depth sampled which was 18 inches.— A. L. Hatfield.

Source, rate, particle size, and time of application of nitrogen for wheat under field conditions.—Monon, a winter wheat variety, was seeded Sept. 16, 1960 on Maury, si.l. in Woodford County. Uniform fertilizer treatments were made prior to the variable nitrogen treatments at seeding time. Three sources of N (oxamide, urea and ammonium nitrate) were used. Two application times were used: all the N drilled with the seed in the fall, and half of the N drilled with the seed with half topdressed the following spring. Three particle sizes (-35, -14 + 35 and -6 + 10) of the oxamide and one (-14 + 35) of the urea and ammonium nitrate was used, with 3 rates of 20, 40, and 60 lb N/A.

A comparison of the three sources in the -14 + 35 particle size indicated little difference in the three materials, but that time of application and rate are most important. There was no grain yield difference between the two methods of applying the N at the 20 lb rate, but at the 40- and 60-lb rates the fall application of oxamide produced more grain whereas the split application of the 40 and 60 lb rates of urea and ammonium nitrate produced more grain.

In an analysis of effect of the particle sizes of the oxamide on grain yield, the fall application was consistently better than the split applications, and the larger the particle the more effective the material was in increasing grain yield. The -6 + 10 mesh size particles applied in the fall at the 60 lb rate produced more grain than did the fall or split applications of the 60 lb rate of ammonium nitrate or urea.

The total nitrogen content of the straw and grain closely paralleled the grain yield measurements in all the comparisons.— A. L. Hatfield.

Effect of ground limestone on crop yield and the pH of the soil.— Experiments with rates, sources and methods of applying lime for alfalfa on Pembroke silt loam and Ladino clover on Grenada silt loam were begun in 1958. One experiment with rates and sources of limestone for corn on Pembroke silt loam is in the fourth year of production.

Dry matter yields of alfalfa and Ladino clover have been increased with the minimum rate of 1½ T limestone per acre, but increased

no further to the maximum rate of 12 T per acre. Corn grain yields in the fourth year were not increased by the use of limestone.

Soil pH has increased with each additional increment of lime on the alfalfa and Ladino plots but has dropped to the level of the checkplots in the corn plots which received 11/2 T/A.—A. L. Hatfield.

Effect of topdressed potash fertilizer on the dry matter production of established alfalfa on Zanesville silt loam soil.— Rates of 0, 120, and 400 lb per acre of K_2O from muriate of potash were applied to a 2-year-old stand of alfalfa which had received 120 lb K_2O per acre annually in the two previous years.

Dry matter yields of two cuttings, May 29 and June 27, were essentially the same from all plots. New growth after the second harvest indicated the need for more potash on the check plots but no yields were taken because of grasshopper damage.—A. L. Hatfield.

Effect of time and rate of application of ammonium nitrate on wheat.— Winter wheat, Monon variety, was seeded Sept. 17, 1960, with rates of 20, 40, 60, and 80 lb N/A either drilled with the seed, applied as a topdressing in late March, or with 10 lb N/A at seeding and the remainder of each rate topdressed in late April when the wheat plants were beginning to joint.

The yield of grain increased as the nitrogen rates were increased. In a comparison of the spring and fall application rate, 20 lb more N were required at all rates when applied in the fall to produce the same amount of grain as when all the N was topdressed in late March. When comparing the 10 lb N applied at seeding and the remainder of each rate topdressed after the wheat began to joint in the spring with the fall applications, the yields were equal with the exception of the 80 lb rate, which produced much better yields when applied in the fall.—A. L. Hatfield.

Potassium release and fixation by soils.—Recent laboratory and greenhouse studies indicated that K release and fixation by drying is a direct function of the exchangeable K level of soils regardless of their K supplying powers. Illite appears to be the source of K released by drying, while K fixation by drying to approximately 6% moisture is attributed to vermiculite. Fixation of K on further drying is believed to be of the montmorillonite type. These studies suggested a K equilibrium level of 0.45 ± 0.1 me. per 100 grams, above which K is fixed by drying and below which drying releases K, if the proper mineral suite is present in the soil.

Cropping of soils which had undergone various drying treatments indicated that at least a portion of the K apparently fixed by drying, as measured by common chemical extractions, is available to plants.—R. H. Dowdy and T. B. Hutcheson, Jr.

Effect of the clover cyst nematode on the growth of red, Ladino, and white clovers.— In greenhouse experiments the growth of Kenland red clover was reduced 50, 57, and 76 percent in soil infested per half gallon with 500, 1100, and 6000 larvae of the clover cyst nema-

tode, respectively. In pots containing an initial infestation of 300 larvae per 500 grams of soil the growth of Kenland red clover, Louisiana white clover and Pilgrim Ladino clover was reduced 47, 31, and 13 percent, respectively, in 5 months.—R. A. Chapman.

Classification, characterization, and adaptability of Kentucky soils.—Progressive soil surveys are in progress in Barren, Butler, Caldwell, Calloway, Estill, Fayette, Harrison, Henderson, Jefferson, and Metcolfe counties. These surveys are joint projects with the USDA Soil Conservation Service. In addition, a progressive soil survey for McCreary county is scheduled to begin in early 1962 as a joint project with USDA Forest Service and Soil Conservation Service.

Detailed soil surveys were completed in Adair, Clark, Elliott, and Fulton counties, and their soil correlations are completed or scheduled for early 1962.

A reconnaissance type soil survey of 14 eastern Kentucky counties—Bell, Breathitt, Clay, Floyd, Harlan, Johnson, Knott, Lawrence, Leslie, Letcher, Magoffin, Martin, Perry and Pike—was instituted with field work to be complete in January 1962, and report to U. S. Government Printing Office in mid-1962. This survey is joint with the USDA Soil Conservation Service and is a part of the Eastern Kentucky Resource Development Program.

Major soil characterization samples were collected from two sites each for Bewleyville, Lexington, and Wellston soil series. This is a part of the continuing characterization of Kentucky soils.—H. H. Bailey.

Tall fescue improvement.—Polycross progenies and synthetics of inbred lines of tall fescue selected for improved palatability, polycross progenies of 73 well-grazed backcross progenies of perennial ryegrass-tall fescue hybrids x tall fescue[2](two generations of backcrossing to tall fescue), and the Ky 31 variety were established in replicated sod plots during 1959 and repeatedly grazed with cattle in 1960 and 1961 to study differences in palatability. Generally the entries well grazed or poorly grazed in 1960 were also well grazed or poorly grazed in 1961. Two new experimental varieties of tall fescue, designated Ky synthetic and 45-50 Outcross, and all polycross progenies of the backcross hybrids except four, were significantly better grazed than Ky 31. Four polycross progenies of the backcross hybrids were better grazed than 45-50 Outcross and 10 were better grazed than Ky synthetic.

Dry-matter yields were obtained from replicated sod plots of synthetic 1 and synthetic 2 of three palatable inbred lines, synthetic 1 and synthetic 2 of five palatable inbred lines, polycross progenies of each inbred line that formed the synthetics, polycross progenies of several selected perennial ryegrass x tall fescue hybrids backcrossed to tall fescue, the G1-25 and G1-32 naturalized and Ky 31 varieties. The polycross progenies and synthetics of tall fescue and backcross hybrids were approximately equal in yield to the naturalized and Ky 31 varieties. The synthetics and polycross progenies of pal-

atable inbred lines of tall fescue were observed to be more resistant to certain leaf diseases during the summer months than the naturalized and Ky 31 varieties.

In an effort to obtain a relatively large population of fertile amphiploids, 80 plants were obtained in 1960 by treating F_1 hybrids of annual ryegrass x tall fescue with colchicine. Eighteen of these were observed to be fertile on the basis of anther dehiscence and were later determined to have 2n=56 chromosomes, an exact double of the F_1 hybrid parent.[1] Approximately 1000 first-generation open-pollinated progenies established in 1960 from twenty-two 2n=56 chromosome amphiploids were studied for fertility and various other characters in 1961. Approximately 60 percent of these plants were judged to be fertile, based on anther dehiscence. The majority of plants were observed to be vigorous, perennial-types that had considerably softer leaf texture than the tall fescue parent. The first-generation population of amphiploids was sampled for chromosome number determinations. Thirty-five first-generation plants were selected for chromosome counts and all were found to have 2n=56 chromosomes. Ninety-six first-generation plants were selected for plant vigor and fertility. Approximately 6000 second-generation progenies from these 96 first-generation amphiploids were established in 1961 for breeding behavior studies.

First-generation progenies of annual ryegrass x tall fescue hybrids (2n=28 chromosomes) backcrossed to annual ryegrass (2n=14 chromosomes) were established in a spaced-plant nursery in the fall of 1959 and studied for fertility and various morphological characters during 1960. The population was observed to segregate into annual and perennial types during the first year of establishment. Most perennial types were judged to be fertile, based on anther dehiscence. Chromosome number determinations revealed these plants had 2n=42 chromosomes. Approximately 1600 second-generation progenies were established in 1960 from the perennial-type hybrids. These progenies were observed during 1961 for various morphological characters. The second-generation plants were found to segregate into annual and perennial types, with 59.9 percent surviving the 1961 growing season. A range of plant types varying from almost pure ryegrass to almost pure tall fescue was observed. Perennial type plants that exhibited both annual ryegrass and tall fescue characters were found.— R. C. Buckner and Paul Burrus, II. (In cooperation with ARS.)

Kentucky bluegrass improvement.— Nine Kentucky bluegrass selections from old pasture sods in central Kentucky are being increased for seed production for further testing in Kentucky and other states. These 9 selections continue to be significantly higher in summer production and more resistant to crabgrass invasion than

[1] Appreciation is expressed to Dr. Arne Hovin and Dr. Helen D. Hill, ARS, U.S.D.A., U. S. Regional Pasture Research Laboratory, University Park, Pa., for chromosome number determinations of all hybrid materials.

commercial bluegrass, as evidenced by results obtained in three separate tests over a period of seven years. In one particular test in which three generations of selections are being evaluated to determine if selections will perform the same in each generation, the selection x generation interaction was not significant. This indicates that a variety formed from these selections would perform similar to the parent materials from which the variety was formed.

Progenies of 114 selections of Kentucky bluegrass made in 1958 from old sods in Tennessee, Georgia, Alabama, and Mississippi were seeded in replicated rows in 1959 for further evaluation. The bluegrass rows were evaluated primarily for disease resistance during the summer months of 1960 and 1961. Progenies of 30 selections were observed to exhibit resistance to foliar diseases. These 30 selections will be established in sod plots for further evaluation and comparison with Kentucky bluegrass selections from old sods in Kentucky and with commercial bluegrass.— R. C. Buckner and Paul B. Burrus, II. (In cooperation with ARS.)

A comparison of Kentucky bluegrass and Kentucky 31 fescue for dairy heifers.— (In cooperation with Dairy Science Department; see page 45.)

Introduction of new plants.— In 1961, twenty-seven accessions of new plants were brought to the Kentucky Agricultural Experiment Station from federal plant introduction stations. Six of the accessions were seeds of six different species of *Trifolium*. Plants grown from these seeds will be used in connection with the red clover breeding program of the Agronomy Department. Twenty-one accessions were plants of five species of *Pinus, Picea, Ligustrum,* and *Salix*. These will be evaluated by the Horticulture Department in respect to their value as ornamental plants.— E. N. Fergus.

ANIMAL HUSBANDRY

Trifluomeprazine (TFM) and diethylstilbestrol (DES) for beef steers on pasture.— Forty steers were divided into a group of 20 steers which received plain salt and a group of 20 which received TFM mixed in the salt so that each steer received 10mg of the tranquilizer daily. The two groups of steers were then subdivided for DES treatment. After 141 days on pasture all steers received a full feed of grain while still on pasture for 67 days. During the first 141 days increases in gain due to TFM were small and nonsignicant. Steers implanted with DES gained 0.39 pound a day faster and were 55 pounds heavier at the end of 141 days. During the final 67 days when steers were fed grain on pasture, there were still no significant increases in rate of gain due to the tranquilizer. Also, the beneficial effect of the stilbestrol implants seemed to disappear, indicating that the stilbestrol pellets had been absorbed at the end of 141 days.— N. W. Bradley and Philip Phar,

Effect of virginiamycin, Terramycin and diethylstilbestrol on fattening and wintering rations for beef steers.— In a replicated fattening trial involving 80 steers sired by the same bull, adding 40, 80, or 160mg of virginiamycin or 80mg of Terramycin per head daily did not affect feedlot performance of steers being fed a fattening ration. Stilbestrol implants produced a highly significant increase in rate of gain (0.51 pound per head per day), but produced no statistically significant effects on carcass data. Steer calves fed a wintering ration composed of corn silage, soybean meal, and hay for 170 days did not respond to either 40 or 80mg of virginiamycin or 80mg of Terramycin per head daily.— Bernard Jones and N. W. Bradley.

Effect of duration and level of treatment with tranimal on steers being fattened in drylot.— Forty fleshy yearling Angus steers were divided into four lots and fed a fattening ration of corn silage, ground shelled corn, and soybean meal. The treatments were as follows: (1) control, (2) 10mg of tranimal per head daily fed during the entire 137-day test, (3) 25 mg tranimal fed for the first 70 days, and (4) 50mg of tranimal fed for the first 42 days of the test. Average daily gains, in pounds, for the various treatments at the end of 42 days were as follows: (1), 2.66; (2), 2.32; (3), 2.34; and (4), 2.87. At the end of 70 days the rates of gain were: (1), 2.45; (2), 2.58; (3), 2.50; and (4), 2.54. At the completion of the 137-day feeding period average daily gains were as follows: (1), 2.31; (2), 2.41; (3), 2.07; and (4), 2.24. Indications are that tranimal (a new tranquilizing agent) may have beneficial effects on rate of gain; however, when the tranquilizer was withdrawn gains seemed to be reduced.— N. W. Bradley and Bernard Jones.

Preweaning and postweaning performance and carcass characteristics of Hereford and Hereford X Red Poll crossbred calves.— Crossbred calves were 116 pounds heavier at weaning than Hereford calves, but Hereford calves graded almost one-third of a feeder grade higher. During the postweaning fattening period, Herefords gained slightly faster than crossbreds, and calves sired by the high-gaining bull gained faster than calves sired by the low-gaining bull. Feed required for 100 pounds of gain favored the Herefords by 134 pounds and the high-gaining calves by 27 pounds. Carcass grades were little affected by either sire or breed. Both Herefords and calves sired by the high-gaining bull had larger rib eye areas than crossbreds or calves sired by the low-gaining bull, respectively. Heifer carcasses graded slightly lower, carried more fat covering over the rib and were about one-third of a grade lower in carcass conformation than steer carcasses.— N. W. Bradley, T. R. Greathouse, W. P. Garrigus, and W. Y. Varney.

Effect of fat and urea on fattening rations for beef steers.— Previous results have shown that urea can satisfactorily replace all the soybean meal and that fat can satisfactorily replace 62 percent of the corn in complete pelleted fattening rations. A combination of fat and urea significantly reduced arte of gain. Neither calcium, 40gm per head

daily, nor lysine, 10gm per head daily, alleviated the depressing effect. This year's experiment included the same type rations containing (1) urea, (2) fat and urea, (3) fat and urea with distillers dried grains with solubles (DDG/S) replacing the soybean meal of ration two, and (4) fat and urea with DDG/S replacing the soybean meal and one-half the urea in ration 2. The combination of fat and urea again depressed gains and neither level of distillers grains alleviated the depressing effect.— N. W. Bradley, B. M. Jones, and G. E. Mitchell.

Effect of plane of winter nutrition and amount of corn fed on grass on steer-fattening programs.— Two lots of calves were fed to gain 1 lb daily during the winter and two lots of calves were fed to gain 1.5 lb daily. One lot of calves at each level of wintering received 2.5 mg of reserpine per head daily. Reserpine treatment did not affect performance. In the spring, 10 steers which had been wintered at the low level and 10 steers which had been wintered at the high level received a limited feed of grain on pasture. A comparable group of steers received a full feed of grain during the summer. Carcass grades were not significantly different for the four treatments, although steers on the low level of wintering and limited grain on grass had the lowest grading carcasses. Steers on a full feed of grain gained 0.26 lb per head daily faster and had 0.14 inch more fat over the ribs, but carcasses graded only one-third of a grade higher.— N. W. Bradley and Howard Baker.

Effect of stilbestrol implants during the preweaning period on postweaning feedlot performance of steers and heifers receiving stilbestrol orally.— The average increase in preweaning gain resulting from stilbestrol implants was 32 pounds for steer calves and 21 pounds for heifer calves. During the postweaning phase when stilbestrol was fed to all calves, previously implanted steers gained faster than control steers, while control heifers gained faster than heifers which received preweaning implants. When the results of both phases are combined, implanted steers gained 55 pounds more than unimplanted steers, but implanted heifers gained 13 pounds less than heifers which received no preweaning implants. These data suggest that preweaning stilbestrol implants are not detrimental to subsequent feedlot performance of steers, but may adversely affect feedlot gain of heifers.— N. W. Bradley and W. P. Garrigus.

Ground, flaked, and pelleted corn for beef steers.— Thirty fleshy yearling Hereford steers were divided into three groups of 10 steers each. All steers were individually fed a fattening ration of corn, alfalfa hay, and soybean meal for 134 days. The experimental variable was either grinding, flaking, or pelleting the corn. Average daily gains and pounds of feed required per 100 pounds of gain were: ground corn, 2.52 and 860; flaked corn, 2.55 and 800; and pelleted corn, 2.73 and 722. Results from the previous year indicated that both flaked and pelleted corn increased gain and improved feed efficiency. This year's results show that the same trend continued for

pelleted corn and although flaked corn improved feed efficiency, rate of gain was not improved. Carcass grades were not affected by any of the feeding treatments.—N. W. Bradley and Bernard Jones.

Ground, flaked, and pelleted soybean hulls for wintering beef steers.— Forty-eight Hereford steer calves, averaging 430 pounds each, were used in a 168-day wintering trial to determine the feding value of ground, flaked and pelleted soybean hulls. Calves on flaked hulls gained .08 lb per day faster than calves on ground hulls. Calves fed the pelleted hulls gained .38 lb per day faster and used 244 lb less feed for each 100 lb of gain than calves fed ground hulls. A fourth lot of calves fed ground pellets during the last half of the trial gained and used their feed similarly to the calves on pelleted hulls. Average daily feed intake was similar, regardless of the form of hulls.— N. W. Bradley and R. R. Garrigus.

Breeding performance in ewes following synchronization of estrus by feeding Provera.—An orally-effective progestational compound, Provera (6-methyl 17-acetoxyprogesterone), was used in attempts to synchronize estrus and time of lambing in ewes. The trial was conducted during the breeding season with 40 commercial ewes. A factorial design was used in which 60 or 90 mg of Provera was fed daily for either 15 or 18 days. None of the ewes came into estrus during treatment. Thirty-eight (95.0%) of the ewes returned to estrus 2 to 5 days (av. 3.2 days) after Provera feeding ended. Variance in time of onset of estrus was reduced from 18.3 to 0.6 for pretreatment and posttreatment estrus, respectively. Average interval from end of feeding to onset of estrus was significantly longer for the 90 mg group (2.7 days vs. 3.6 days, $P<.01$) and for the 18-day group (2.9 days vs. 3.6 days, $P<.01$). Ewes showing estrus were artificially bred and 19 were slaughtered. Ovulation rate was 1.4 and 63% of the ova were fertilized. Sixteen of the remaining 19 ewes (84.2%) lambed to the first post-treatment breeding. All of these ewes lambed within a seven-day period and the lambing rate was 1.4. The treatment was effective in concentrating breeding and time of lambing for most of the ewes. There was no evidence that fertility was adversely affected. Use of orally effective compounds for synchronizing estrus have many advantages over progesterone, which must be injected at frequent intervals in order to be effective.— J. S. Evans and R. H. Dutt.

Effect of scrotal wool on testicular temperature and semen production in rams.— Scrotal wool was removed by shaving, and rectal and testicular temperatures were studied in Southdown rams. Control rams and rams with the scrotal wool removed were exposed to 60°F temperature or to 90°F temperature for one week. Average testicular temperature of the control rams at the lower environmental temperature was 94.7°F., and 94.4°F for the shaved rams. At the higher environmental temperature the average testicular temperature was 97.7°F for the control rams and 96.1°F for the sheared rams. The average rectal temperature of rams in the cooler environment was significantly lower than when in the heated room. Exposure to

the high temperature resulted in an increase of 1.7°F in testicular temperature of the rams with scrotal wool removed and an increase of 3.0°F for control rams. Increased testicular temperatures have been shown to have a detrimental effect on spermatogenesis and fertility in rams. In a second trial scrotal wool was removed from a group of rams on September 13. During the next five weeks this treatment did not result in any significant change in semen characteristics when compared with unshaved rams. There was a significant decrease in the percent of abnormal cells during the five-week period in both groups of rams. There was no significant change in semen volume, motility, and sperm-cell concentration.—R. J. Ericsson and R. H. Dutt.

Fertility and embryo survival in ewes following removal from heat stress at or before breeding.— Exposing ewes to high environmental temperature at the time of breeding has been found to cause low fertility and increase the percentage of morphologically abnormal ova. In order to obtain information on whether the ova are damaged before ovulation commercial crossbred ewes were placed in a room at 90°F temperature, relative humidity 60%, on the twelfth day of the cycle before breeding. One group of ewes was removed from the heat after four days or approximately 1 to 2 days before onset of estrus. A second group remained in a heated room until onset of estrus. This group was removed from the heat at time of breeding. A control group of ewes was also bred and half of the ewes in the three groups were slaughtered for fertility data. Estimates of embryo loss were calculated from fertility and the lambing data from the remaining ewes in each group. Fertilization rate was 92.3%, 100%, and 91.7%, in the control and the two heated groups, respectively. There was no increase in morphologically abnormal ova from the treated ewes. Eighty percent of the ewes in each of the three groups lambed. Estimated embryo loss was 16.7% in the control ewes and 12% for the treated groups. These results indicate that ova from ewes exposed to high temperature before breeding are capable of fertilization and developing into normal embryos, if the heat stress is removed at time of breeding. In studies where ewes have been kept in the heated room after breeding, fertility was reduced and embryo loss was as high as 90%.— R. H. Dutt.

Attempts to eliminate sexual odor in the boar carcass.— Microscopic studies of glands in the preputial area of boars show that similar glands are also distributed in the area surrounding the umbilical scar. The end of the sheath and the umbilical area were removed from young boars to be slaughtered at one year of age. No odor was detected in fat samples from these boars before slaughter. However, odor was present in samples from unoperated boars. Odor was present in the carcass of one of three operated boars. One out of 10 replies from consumers receiving sample shoulder slices from one boar stated that a boarish odor was apparent while cooking. None of the other replies indicated any undesirable odor or flavor. None of the

six replies returned from consumers receiving samples from the second operated boar reported any objectionable odor or flavor. Boars were skinned immediately after slaughter for the purpose of removing the sebaceous glands. This did not reduce the odor in the carcass. Excision of the preputial area, the suburethral diverticulum, and the umbilical scar area before slaughter was not effective in reducing odor in the carcass. Apparently, the odorous material is dessiminated throughout the body fat before rigor mortis sets in following slaughter. —R. H. Dutt and C. E. Barnhart.

Initiation of breeding activity and pregnancy in anestrous ewes by use of Provera and Pregnant Mare Serum.—Forty anestrous ewes were started on treatment June 6. The ewes were group-fed once a day at the rate of 50 milligrams of Provera (6-methyl 17-acetoxyprogesterone) mixed in the grain ration. Twenty ewes were fed for 7 days, and 20 for 14 days. The second day after ending Provera feeding each ewe was injected subcutaneously with 500 International Units of Pregnant Mare Serum. In the 7-day group 5 ewes (25%) and in the 14-day group 13 ewes (65%) came into estrus within 2 days after the Pregnant Mare Serum injection. These ewes were bred artificially on the day of estrus, and all ewes were bred on the third day after injection. Half of the ewes showing estrus in each group and half of those not showing estrus were slaughtered. All of the ewes had ovulated except one (average 1.5 per ewe). Thirty-five percent of the ova recovered were fertilized. Fertilized ova were recovered from only one ewe that had not been in estrus. In a group of control ewes none came into estrus during the trial. Thirty percent of the 7-day ewes and 40 percent of the 14-day ewes not slaughtered subsequently lambed. In the 7-day group two ewes that had not been in estrus lambed, but in the 14-day group only the ewes that had been in estrus lambed. The results of this trial show that a pretreatment period with a progestational agent of more than seven days duration is necessary for induction of estrus in a high percentage of anestrous ewes. However, lambing percentages were similar for the two groups of ewes.— J. S. Evans and R. H. Dutt.

Keeping quality and shrinkage of hams from hogs of different degrees of fatness.— Hams from 57 Hampshire hogs slaughtered in the fall of 1960 and the spring of 1961 were dry-cured, smoked, and aged for 6 months at 65°F with a relative humidity of approximately 60%. Hams were divided into two fatness groups on the basis of average backfat thickness. Group 1 (31 hogs) was from hogs with average backfat thickness of 3.07cm (range 2.6 -3.1); group 2 (27 hogs), 3.75cm (range 3.5 - 4.3). Shrinkage increased throughout aging with the leaner hams having slightly greater shrinkage. The average percent shrinkage after six months aging was 30.2 for group 1 and 28.7 for group 2. Initial iodine numbers were greater (66.19 vs. 65.05) for the leaner group. Both groups decreased slightly during aging. Initial peroxide numbers were similar in both groups and increased errat-

ically in both groups during aging. Initial free fatty acid values were similar in both groups but were slightly higher (18.36 vs. 15.92) in the leaner group.—J. D. Kemp, G. C. Skelley, and W. Y. Varney.

Effects of partial pumping on the characteristics of aged hams.—Sixty-four hams were divided into four equal groups. Eight hams of each group were dry-cured and the companion hams were pumped to 4, 6, 8, and 10 percent of their fresh weight, for groups 1 through 4, respectively. Enough dry-cure was added to the pumped hams to bring the total cure used to 10 percent of the fresh weight. The hams were cured 1½ days per pound of fresh weight, smoked and aged for 6 months at 65°F and 60 percent relative humidity. The hams were weighed and sampled at regular intervals during the processing and aging process. The fat samples were analyzed for iodine numbers and free fatty acid content. Salt content was determined on all the hams. Organleptic analysis was also conducted on all the hams. Mean shrinkage values of the dry-cured and pumped groups 1 through 4 respectively were 27.76, 25.24, 23.84, 22.73, and 20.59. Free fatty acid content increased while the iodine numbers decreased over the processing and aging period. Pumped hams had a higher salt content than the dry-cured hams. The dry-cured hams had higher scores for flavor, saltiness and overall satisfaction than the pumped hams, however, they both were ranked the same on tenderness. There were no significant difference in any of the organleptic factors among the different pumped groups.—R. W. Rogers, J. D. Kemp, and W. Y. Varney.

Relative cut-out percentages and values of light and heavier weight hogs.—Two groups of 30 hogs averaging 159 and 215 pounds, respectively, were evaluated. In percents of total weights of individual cuts, the light hogs were significantly higher in boneless and defatted ham, boneless and defatted ham cushion, ham bone, and sirloin-end section of loin. The heavier hogs were significantly higher in ham fat and skin. There were no significant differences between rib-end and center loin sections, boneless butts, and boneless and skinless picnics. The heavier hogs yielded a significantly higher percent of skinless, smoked bacon. The percent yields of sliced bacon (based on skinless, smoked side weights) for the light and heavier hogs were, respectively: First grade, 65.25 and 71.13; second grade, 23.55 and 15.95; third grade, 6.39 and 8.21; and scrap, 4.72 and 4.69. The light hogs were significantly higher in percent of lean and primal cuts on both the live weight and carcass weight bases. The heavy group had a significantly higher carcass yield but the light group was worth significantly more per cwt. on both the live weight and packer weight bases.—W. Y. Varney, James D. Kemp, C. D. Phillips, and C. E. Barnhart.

Estimation of fat composition of Kentucky spring lamb from various cuts.—Estimating equations, using data from 106 Kentucky spring lambs, were developed for determining the percent fat in lamb

carcasses from the percent fat in various cuts. Highly significant correlations existed between the fat of various cuts and the fat of the carcass. The correlation coefficients and prediction equations for the cuts were: (Y = % fat in carcass, X = fat in cut) Rib, 0.90, Y = 6.68 + .70X; Loin 0.88, Y = 10.12 + .64X; Leg, 0.88, Y = 5.60 + 1.09 X; Shoulder, 0.88, Y = 5.76 + .95X; Breast and Flank, 0.77, Y = 7.81 + .55X; Neck, 0.72, Y = 21.11 + .46X; Fore shank, 0.30, Y = 26.54 + .37X. The equation for the rib appeared to be the most satisfactory.— R. A. Field and J. D. Kemp.

Quick aging of hams.— Two trials using dry-cured hams and heated aging cabinets were completed and another is in progress. In trial I temperatures were maintained at 80, 90, 100, and 110°F, respectively, in the cabinets, with a relative humidity of approximately 60%. In trials II and III the temperatures were 75, 85, 95, and 105°F. In trial I, 8 hams were used per cabinet. They were tempered at 65°F for 3 days after smoking and then placed in the aging cabinets. Average percent shrinkage after 12 weeks was 25.1, 25.2, 25.5, and 29.8% respectively, and after 16 weeks 27.8, 26.9, 27.2, and 32.9%. Free fatty acid developed normally while peroxide values were higher than in normal aged hams. The color was satisfactory in the 80, 90, and 100° cabinets but was unsatisfactory in the 110° cabinet. A few hams soured, evidently as a result of the high initial aging temperature. Some sound hams were excellent while others were not satisfactory. In trial II, 9 hams were used per cabinet. They were tempered at 65°F for 14 days and then aged in the cabinets for 12 weeks. Shrinkage after 12 weeks averaged 26.5, 26.5, 28.2, and 30.0 respectively. The 105° cabinet produced off-colored, over-aged hams while the other three cabinets produced red colored hams with a typical aged ham odor. Free fatty acid values and peroxide values developed normally. A taste panel scored the experimental hams more tender than control hams aged for 6 months at 65°. Flavor was excellent in most hams. Preliminary data from Trial III have been very satisfactory for the three lower temperatures.— J. D. Kemp and G. C. Skelley.

Carcass evaluation of lambs from selected crosses.— Fifty-nine twin lambs grading choice or prime and sired by three feedlot tested Southdown rams mated with similar western type ewes were evaluated for carcass characteristics when they reached approximately 85 pounds. On a standard feeding test Group I ram gained 0.36 lb per day; Group II, 0.32 lb per day; and Group III, 0.21 lb per day. Average carcass weight per day of age was 0.224 for all lambs and 0.206 and 0.241 for the ewe and wether lambs, respectively. Average carcass weight per day of age was 0.217, 0.230 and 0.227 for ram groups, I, II and III, respectively. Percents fat, bone, and lean averaged 33.60, 14.56, and 51.24 for all lambs. For all ewe lambs the percents were 34.80, 14.03, and 50.48 and for the wether lambs the percents were 32.52, 15.04, and 51.71, indicating that the wether lambs were leaner and had a higher bone percent. Percents fat, bone and lean for the three groups were 32.36, 14.76, and 51.75 for group

I; 33.80, 14.82, and 51.25 for group II; and 34.44, 14.18, and 50.51 for group III, showing that the slower gaining rams sired the fatter lambs and the faster gain rams sired the meatier lambs. Average loin eye size and average rind fat, adjusted to a 45 lb carcass wt., averaged 1.93 sq. in. loin eye and 0.27 in. rind fat for all lambs. Ewe lambs averaged 1.92 sq. in. and 0.28 in. while wether lambs averaged 1.94 sq. in. and 0.26 in., respectively. Group I averaged 1.83 sq. in. and 0.24 in.; group II averaged 1.94 sq. in. and 0.24 in.; and group III averaged 2.01 sq. in. and 0.31 in., respectively, showing again that slower gaining rams sired fatter lambs.— R. A. Field, J. D. Kemp, W. Y. Varney, and P. G. Woolfolk.

Correlation of the various swine carcass cuts and measurements.— Data used in this study were collected from pigs slaughtered over an 8-year period. These pigs were purebred Hampshires which had been on a production testing program. A total of 395 head were involved—197 barrows and 198 gilts. Of these, 253 were spring farrowed, and 142 were fall farrowed.

Pigs were fed, in confinement, a simple corn-soybean meal growing-finishing ration which was fortified with vitamins, minerals, and a low level of antibiotic.

Percent of ham expressed as percent of carcass weight was more highly correlated with percent of lean cuts; therefore, it was the best single variable in predicting total carcass leanness. Ham fat thickness seems to be a better measure of carcass fat than does average backfat thickness.— C. E. Barnhart, M. D. Whiteker, and J. D. Kemp.

Virginiamycin, a new antibiotic for growing swine.— Five experiments were conducted to determine the value of virginiamycin as a feed additive for growing pigs. In the first experiment 40 purebred Hampshire pigs, averaging 31 pounds, were allotted to two replicate lots of 5 pigs each to each of four ration treatments. All lots of pigs were adequately housed in the same manner. Each pen was thoroughly cleaned and steamed before the experiment was started. Pigs were all treated for internal and external parasites and vaccinated for hog cholera and erysipelas, and male pigs were castrated before they were placed on feed. All groups were self-fed their respective ration and had access to an automatic waterer. Pens were kept adequately clean at all times. Different ration treatments were: (1) basal, (2) basal + 40gm chlortetracycline per ton, (3) basal + 20gm virginiamycin per ton and (4) basal + 40gm virginiamycin per ton. The pigs were all fed 69 days.

The lot of pigs fed 40gm virginiamycin per ton gained 26.64 percent faster than the basal pigs and 16.66 percent faster than pigs fed 40gm of chlortetracyline per ton. Difference in gains between pigs receiving 40gm virginiamycin and pigs fed the basal ration was significant at the 1 percent level. Difference in gains between pigs receiving 40gm virginiamycin and pigs receiving 40gm chlortetracycline was significant at the 5 percent level.

The second experiment was conducted under the same conditions as described for Experiment I. The same basal ration and the same levels of chlortetracycline and virginiamycin were fed. Pigs were allotted weighing an average of 36 pounds and were fed to a lot average of 200 pounds. Results of this experiment have been summarized from the start of the experiment until pigs weighed about 110 pounds, from 110 pounds in weight until 200 pounds, and for the entire period.

The 20 and 40gm per ton of virginiamycin increased gains 19.72 percent and 24.14 percent, respectively, over the basal ration for the first period of the experiment. These differences were statistically significant at the 5 percent level. The 40gm level of virginiamycin improved rate of gain 17 percent over the chlortetracycline treatment during the first period. Also, the 20 and 40gm levels of virginiamycin improved feed efficiency by 21.0 percent and 18.8 percent, respectively, over the basal. The 20 and 40 gm levels of virginiamycin improved feed efficiency by 11.29 percent and 13.34 percent, respectively, over the 40 gm level of chlortetracycline.

There were no statistically significant differences in rate of gain between the different treatments for the period of 110-pound to 200-pound live weight of the pigs. However, for the entire feeding period, pigs fed the 40gm level of virginiamycin gained significantly faster than the basal pigs ($P<0.01$) or the 40 gm level of chlortetracycline pigs ($P<0.05$). This was an increase in gains of 15.97 percent over the basal and 11.33 percent over chlorteracycline. The 40gm of virginiamycin also improved feed efficiency 14.82 percent over the basal and 7.84 percent over the chlortetracycline. The 20gm level of virginiamycin increased gains 11.11 percent over the basal, thus approaching significance, and 6.66 percent over the 40gm level of chlortetracycline.

The third experiment involved individually fed pigs confined to small crates with wire floors. Each crate was equipped with a self-feeder and automatic waterer. Pigs averaged 26 pounds when placed on feed and were taken from the experiment when each pig reached 100 pounds. Pigs were cared for and prepared for the experiment in the same way as those used in the two previous experiments. Five pigs were individually fed each of the following ration treatments: (1) basal, (2) basal + 10gm virginiamycin per ton, (3) basal + 20gm virginiamycin per ton, (4) basal + 40gm virginiamycin per ton, (5) basal + 80gm virginiamycin per ton, (6) basal + 10gm chlortetracycline per ton, and (7) basal + 20gm chlortetracycline per ton.

There were no significant differences in rate of gain or feed efficiency among the various treatments used in this experiment. However, virginiamycin did increase gains over the basal when fed at all levels except the 20gm level. Virginiamycin fed at all levels improved feed efficiency over the basal ration. The 40gm and 80gm levels of virginiamycin increased gains 14.9 percent and 13.2 percent, respectively, over the basal ration. This was of interest since little or no improvement in rate of gain has been noted at this experiment

station from feeding antibiotics to pigs under this kind of environment.

In experiment V, 70 purebred Hampshire pigs averaging 36 pounds were allotted to two replicate lots of 5 pigs each to each of seven ration treatments. All pigs were prepared for the experiment as described in Experiment I. The same equipment was used for this experiment as for the first two experiments. The same basal ration used for the three pervious experiments was used for this experiment. The following ration treatments were self-fed: (1) basal, (2) basal + 10gm virginiamycin per ton, (3) basal + 20gm virginiamycin per ton, (4) basal + 40gm virginiamycin per ton, (5) basal + 80gm virginiamycin per ton, (6) basal + 10gm chlortetracycline per ton, and (7) basal + 20gm chlortetraycline per ton. Pigs were fed to a lot average weight of 100 pounds.

Again virginiamycin improved rate of gain and feed efficiency over the basal ration, although differences in rate of gain were not of statistical significance. When compared with chlortetracycline-fed pigs, virginiamycin-fed pigs gained faster, except at the 10gm level, and more efficiently.— C. E. Barnhart, J. C. Robertson, and H. W. Miller.

Evaluation of creep rations for lambs.— Five lots of either 19 or 20 crossbred western ewes and their lambs were used in a trial to determine the value of four different creep rations. Lambs raised were treated as follows: Lot 1—control, no creep; Lot 2—simple creep mixture, 89.0 percent cracked corn, 10.0 percent soybean meal and 1.0 percent Aureomycin Crumbles; Lot 3—simple creep mixture made up with shelled corn; Lot 4—simple creep mixture made up with pelleted corn; Lot 5—complex creep mixture, 56.5 percent cracked corn, 30.0 percent soybean meal, 5.0 percent alfalfa meal, 5.0 percent sugar, 1.5 percent bonemeal, 1.0 percent phenothiazine salt, and 1.0 percent Aureomycin Crumbles. Ewes in all lots were fed the same ration until March 28, when they were put on bluegrass pastures.

Average daily gain of single lambs for the trial including both drylot and pasture periods ending June 16 was .45, .58, .54, .52, and .56 pound, respectively, for the five lots. Average daily gain of twin lambs was .46, .50, .48, .51, and .55 pound, respectively, for the five lots. For statistical analysis 100-day lamb weights were adjusted to a single Hampshire-sired lamb basis. Differences among 100-day adjusted weights were significant at the 1-percent level. Lambs receiving the simple cracked corn creep ration and the complex creep ration were significantly heavier at the five percent level than non-creep-fed lambs.— P. G. Woolfolk, J. M. Gay, and C. M. Reese.

Sheep management study, Eden Shale Farm.— One hundred blackface Montana ewes and their lambs were used in a sheep management trial at the Eden Shale Farm in Owen county. All ewes were bred to Southdown rams. Lambs were allotted to the following treatments: Lot 1—control, no creep; Lot 2—creep-fed in barn and on pasture; Lot 3—creep-fed in barn, weaned, and fed in barn beginning April 27. The creep ration consisted of 77.5 percent

cracked corn, 20 percent soybean meal, and 2.5 percent Aureomycin Crumbles. On August 1 all lambs remaining were turned together and fed on pasture. Feeding and management of ewes was the same for all groups from the beginning of the trial to weaning. Ewes were wintered on corn silage, alfalfa hay, shelled yellow corn, and soybean meal. Phenothiazine-salt, bonemeal, ground limestone and water were available, free choice.

Marketing Date	*Lot 1 Control No. Lambs*	*Lot 2 Creep Fed No. Lambs*	*Lot 3 Creep Fed-Early Weaned No. Lambs*	*Price Per cwt.*
May 26	1	3	3	$25.50
June 22	2	2	7	22.15
July 5	1	6	6	23.00
July 25	0	6	6	20.00
August 31	7	10	8	20.00
				and 5.00[1]
September 24	8	4	1	17.00
November 14	15	7	2	18.00
December 13	3	1	2	17.50
Total	37	39	39	.....

[1] $5.00 per cwt for 4 lambs from Lot 3 and 1 from Lot 2 that were foundered.

It is evident that both the creep-fed and the creep-fed-early weaned groups moved to an earlier and stronger market. Creep feeding during the barn period before ewes and lambs went to pasture produced a 16-percent increase in rate of gain and played a large part in getting Lots 2 and 3 marketed earlier. Creep feeding in drylot is definitely beneficial. More work is needed before final conclusions on early weaning and creep feeding on pasture can be made.— P. G. Woolfolk, M. A. Slaughter, and O. D. Hawkins.

Shearing of Hampshire-cross Montana and Suffolk-cross Texas ewes prior to breeding.— A third year's work on an experiment begun in 1958 to study the effect of shearing ewes prior to breeding on their subsequent performance was completed in 1960-61. Forty Hampshire-cross yearling Montana ewes not used previously were included in the trial. In addition, 24 Hampshire-cross 2-year-old Montana ewes, 13 Suffolk-cross 3-year-old Texas ewes, 40 Hampshire-cross 3-year-old Montana ewes, and 27 Hampshire-cross aged Montana ewes previously used in the trial were included. Groups that were sheared in the 1959-60 trial served as unsheared controls in this trial. Control ewes for the yearling group were selected at random. Ewes were sheared during the period July 27-29 and were placed with rams on August 4. One-ram ewe groups were made up according to shearing treatment, type and age of ewe. The seven rams used were also sheared prior to being turned with the ewes.

One sheared and one unsheared yearling, and one sheared and two unsheared aged Montana ewes failed to lamb. Lambing percentages were high in most groups (120 to 189%). Shearing treatment seemed to have no consistent effect on lambing percentage. Sheared ewes lambed earlier (9 days to 1 month) in three of the five comparisons. The sheared 3-year-old and aged Montana ewes failed to

lamb earlier than their respective control groups. In this trial, as in previous trials, shearing younger ewes was more beneficial than shearing older ewes. The 3-year-old Montana group which showed no advantage in favor of shearing this year had previously responded as yearling and 2-year-old ewes. This is the first year the Texas group has shown an advantage in favor of shearing. However, one ewe in the unsheared group lambed over two months later than any other ewe in the group and was mainly responsible for the late average lambing date in that group.

In all sheared groups the lambing season was completed earlier (11 days to 3 months) than in corresponding control groups. No consistent differences were noted in 56-day lamb weights or fleece weights of ewes. Based on results of the three years' work, shearing prior to breeding definitely tends to increase earliness of lambing in yearling and 2-year-old Montana ewes. It appears to be of no benefit with Texas ewes containing more fine wool breeding or with older Montana ewes.—P. G. Woolfolk, L. H. Boyd, and C. M. Reese.

Carotene disappearance from the rat intestine: effect of dietary nitrate and nitrite.—Three trials were conducted to study the effect of adding 0.5 and 1.0% KNO_2 and 2.0 and 4.0% KNO_3 to the diets of vitamin A-fed rats on carotene disappearance from the ligated rat intestine. Disappearance was determined by injecting .3mg of B-carotene into the small intestine ligated at both ends and incubating in the live rat for 3hours. The intact intestine was then removed and analyzed for carotene. Carotene disappearance from rats fed KNO_2 or KNO_3 was significantly greater than from controls. The treatments also significantly increased carotene levels in the serum. In a 5-week trial, maximum effect was attained in 2 weeks. Increasing the amount of KNO_2 above 0.5% or KNO_3 above 1.0% did not increase the effects. Feed consumption was not affected.—T. R. Greathouse, C. O. Little, and G. E. Mitchell, Jr.

ANIMAL PATHOLOGY

Parasite control in sheep.—A series of seven Ruelene drenches at 3-week intervals was more effective than seven phenothiazine drenches in controlling gastro-intestinal parasites. Although one of 10 lambs treated with Ruelene died their average daily gain (.19 lb) was slightly better than that (.17 lb) of the phenothiazine-treated lambs. Similar lambs kept in drylot and treated with four Ruelene drenches at 3-week intervals showed poor weight gains (.07 lb) and two of five died. Tests with a purified phenothiazine against resistant (strain B) *Haemonchus contortus* resulted in a higher (but not statistically significant) average removal than two N. F. Green phenothiazines. The average removals for male and female *H. contortus* for purified phenothiazine were 19.2% and 92.8%, and for two N. F. Green products were 59.5% and 78.8% and 57.8% and 80.3%. The anthelmintic activities of single oral doses of Thiabendazole at 100mg/kg, Ruelene at 125 mg/kg, and phenothiazine (microfine,

purified) at 550 mg/kg were evaluated in two field tests by post-treatment reductions of worm egg counts. Thiabendazole was most effective, Ruelene was intermediate and phenothiazine was least effective. Haemonchus was the dominant species, while eggs of Ostertagia, Trichostrongylus, Cooperia and Oesophagostomum were also found in the pre-treatment examinations. Relatively large numbers of Strongyloides eggs were present in one of the tests and the numbers were quite effectively reduced by the Thiabendazole, while neither Ruelene nor phenothiazine had any appreciable effect.— J. H. Drudge, J. Szanto, Z. N. Wyant, and G. Elam.

Vibrio fetus infection of sheep.— Infection experiments indicated practical use of susceptible lambs for investigating immunity in ovine vibriosis. Abortion undoubtedly results from infection of the placenta and fetus by way of the blood stream. Prevention of bacteremia in lambs by vaccination therefore is believed to be a more reliable index of immunity than percentage of abortion. The results obtained by vaccination of an infected flock with autogenous bacterin were encouraging, with interruption abortion in two flocks following vaccination. Challenge trials following use of bacterin, with the qualitative prevention of bacteremia as an index of immunity, did not result in unequivocal confirmation of field observations. The average duration of bacteremia in two groups of control lambs was 3.6 and 3.1 days, as compared to 1.6 and 1.5 days in vaccinated groups. Three of 20 controls had bacteremia for 9 days and five for 3 days. The majority (7 12) of vaccinates experiencing bacteremia were positive for only one day while the longest period was 3 days (2 12). The reexposure of 9 lambs, 50 days after the initial exposure, to infectious doses of *V. fetus* in a controlled experiment produced no bacteremia in the principals.— John T. Bryans.

Parasite control in the horse.— Phenothiazine-resistant strongyles were observed on three farms. Fifty mares that received therapeutic doses of phenothiazine had an average post-treatment reduction of EPG of only 1.5%. Four phenothiazines, two regular N.F. Green, one microfine, and one microfine and purified were used without apparent difference of activity. Combinations of phenothiazine and Parvex or other piperazine were used on 40 of the safe mares with 95% reduction of EPG. Combinations of phenothiazine and piperazine had a synergistic effect against large and small strongyles in critical tests. Combined full therapeutic doses of each drug of a half dose of phenothiazine plus a full dose of piperazine resulted in 95-100% removal of small strongyles, *Strongylus vulgaris* and *S. edentatus*. Additional critical tests on the organic phosphate, Bayer 1.13 59, confirmed effective activity against bots in single doses at 30 to 40 mg kg. It appeared equally effective whether given by stomach tube or on the feed. Its anthelmintic action appears to be characterized by (1) effective removal of ascarids, (2) partial removal of pinworms and small strongyles, and (3) very little action against large strongyles

except at toxic dose levels.— J. H. Drudge, J. Szanto, Z. N. Wyant, and G. Elam.

Pathological conditions of horses.— Weanlings and yearlings or older wobblers reveal lesions quantitatively different but qualitatively identical: malformation of the apophyseal joints of the cervical spine. Preliminary results suggest the malformation is related to improper growth of cartilage forming these joints. Neuromuscular lesions are the basic finding in contracted foals. Delay in rate of innervation of skeletal muscle in the fetus appears to be corrected by birth but contracture of muscle remains. A cystic, hyperplastic change in the endometrium has been identified as a common lesion in old, barren mares. The mechanical properties of proximal sesamoid bones are being studied, correlating known tensile and compressive forces with stress trajectories within the bone. Mechanical analysis of bony splints indicate that movement of the splint bone on the cannon bone with tearing of the interosseous ligament is a basic cause of splints. Significant lesions of arteriosclerotic type have been identified in many horses, including young foals. The role of endocrine factors is being investigated. Degenerative changes in intervertebral disks and vertebrae of horses have been identified and are being classified and described.— J. R. Rooney.

Immunization of mares for preventing fetal rhinopneumonitis.— Accumulative field tests for 3 years on 60 farms included immunizing inoculations with hamster-adapted virus for mares with 4298 pregnancies. Abortions from fetal rhinopneumonitis were 0.07% from unclassified virus, 0.32% from the vaccine virus, and 0.56% from native virus; a total of 41 abortions, 0.95%. During the same period, 35 nonparticipating farms with 477 pregnant mares had 75 (16.8%) abortions from fetal rhinopneumonitis.—E. R. Doll.

The in vitro cultivation of the parasitic stages of Cooperia punctata, Cooperia oncophora, Ostertagia ostertagi, Ostertagia circumcincta and Ostertagia trifurcata.— Utilizing a medium composed of chicken embryo extract, serum, sodium caseinate, vitamins, and an extract of swine liver, a balanced salt solution, antibiotics and roller drum techniques, it was possible to cultivate these parasites of cattle and sheep to the adult stage.— S. E. Leland.

Experimental infection of the Mongolian gerbil with the domestic animal pathogen Trichostrongylus axei.— The gerbil was susceptible to experimental infection with *T. axei* from four sources, two equine and two bovine.—S. E. Leland.

Propagation of equine arteritis virus.— Virus previously passaged 82 times in cell cultures of horse kidney was propagated and passed serially in cell cultures of hamster kidney. Propagation of the virus in the cell culture systems reduced pathogenicity for horses but antigenicity was retained.—J. C. Wilson.

Some quantitative and pathologic aspects of natural and experimental infections of Trichostrongylus axei in the horse.—The pathologic changes associated with natural infections of *T. axei* were produced experimentally by inoculation of horses with this worm. The lesion begins with a hyperemia and progresses to lymphocytic infiltration, catarrhal inflammation, necrosis, erosion of the mucosa and to chronic proliferative inflammation. All stages may be present in one stomach. The proliferative changes, however, result from rather long duration of infection because they had progressed only moderately at 395 days after inoculation. An average prepatent period of 25.3 days and an average male/female worm ratio of 0.72 were observed. An average ratio of 22.1 larva per adult female per 24 hours was observed.—S. E. Leland, J. H. Drudge, Z. N. Wyant, and G. W. Elam.

Viral diseases of horses.— Equine rhinopneumontis virus produced "plaques" on monolayer cell cultures of ovine, porcine, and equine kidney. The technique is applicable in viral investigation to isolation, neutralization, mutation, development of pure lines, enumeration, and growth curves. Horses infected with native arteritis virus yielded virus daily for 8 to 10 days from nasal secretions inoculated into tissue culture. Succeeding passage of arteritis virus in tissue culture reduced recovery of virus from nasal secretions. Arteritis virus was not recovered from nasal secretions of horses inoculated intramuscularly with 116th tissue culture passage or following challenge of horses immunized by previous inoculation with virus propagated in tissue culture. Virus was found in all organs and most body fluids of fatally infected horses. Native virus and virus previously adapted to cultures of equine kidney, were propagated as readily in cultures of rabbit kidney as in cultures of equine kidney. Cell cultures of rabbit kidney are an alien host which is desirable for preparation of a vaccine. Passage of arteritis virus 131 times in cultures of horse kidney and 20 times in rabbit kidney reduced pathogenicity for horses but antigenicity was retained.— W. H. McCollum and J. C. Wilson.

The influence of superimposed nematode infection plus grain supplement on the serum proteins of pastured calves.—Grain supplement was unsuccessful in comletely counterbalancing the influence of superimposed infections. This conclusion was reached on the basis of relative differences in blood changes of two groups of six calves in which one group received a grain supplement and inefective nematode larvae while the other group received no grain supplement or infective larvae.— S. E. Leland, J. H. Drudge, and R. P. Dillard.

Sheep nose bot control.—(In cooperation with Entomology and Botany Department; see page 46.)

Hypoderma lineatum in cattle (baby beef) gullets.—(In cooperation with Entomology and Botany Department; see page 48.)

DAIRY SCIENCE

Relationship of bacterial types to spoilage of pasteurized milk held at 35°, 41°, and 50° F.— Some psychrophilic bacteria fail to produce countable colonies on agar plates incubated 7 days at 5° C. (41°F).

From a single colony selected from a psychrophilic plate inoculated with a sample of raw milk, 23 distinct strains were isolated. Two-strain combinations of these 23 sub-cultures and 7 strains obtained from isolated mother colonies from different milk samples were tested for associative action using various biochemical tests. Associative action was found in a few combinations. Inhibitory activity was also observed. Increased rate of growth at 5°C (41°F) due to associative growth also was observed. No further explanation for the apparent attraction between the 23 psychrophilic strains is offered.—W. E. Glenn.

Problems in processing and marketing creamery butter in Kentucky.— Of the 136 commercial churnings of butter subjected to the phosphatase test, 4.5% were positive immediately after churning. Only 3 samples (2.0%) gave "false positive" results at the end of 24 hours, as compared with 22% the previous year. Three additional samples were "false positive" after one week, and one sample each after 2- and 4-week storage periods. Samples were obtained from 5 plants and all positive results were confined to two plants.—T. R. Freeman and John L. Bucy.

Preparation and use of frozen cultures for making cultured milk products.— A limited number of cultures, after various periods of frozen storage, were tested for activity on a laboratory scale. Total milk solids concentration of the incubating medium was used at 3 levels—10%, 13%, and 16%—with and without $CaCO_3$, in an effort to protect activity after extended frozen storage. Cultures varied markedly in their ability to survive such storage. Those stored in the highest concentration of milk solids, with $CaCO_3$ added, maintained the highest levels of activity. Even under these conditions some cultures were not active enough for practical use after less than a month in frozen storage.—A. W. Rudnick, Jr.

Low fertility semen in relation to embryonic deaths in dairy cattle.— On the average, about 7% of the 30-60 day non-return cows return for a second service at a later date. This percentage was found to increase 0.31 units for each unit decrease in fertility. Covariance and partial correlations indicated that each day of increasing age of semen at the time of service lowered fertility about 3.4 percentage units, but had little or no independent effect on delayed returns. The 30-60 day non-returns (i.e. conception rate) of 81,944 cows averaged 78% with a standard deviation of 5.9 percentage units among bulls. Where genetic superiority is reasonably certain, semen having a fertility 5-10 percentage units below average does not represent too great a hazard, but when genetic merit is equal, the semen with highest fertility should be chosen.—Durward Olds and Harold Caudill.

Histopathology of uteri in repeat-breeding cattle.—In preliminary examination of tissue sections of uteri from 66 repeat-breeding cows, 45.4% were normal, 31.8% showed marked thickening of arterial walls in the mucosa (elastosis?), 18.2% had cystic glands, 9.1% showed various degrees of endometrial atrophy, and only 1.5% showed evidence of active endometritis. While numbers are still too small, fertilization rates appear to be noticeably higher in the animals with histologically normal uteri (71.4% of 28) than in those having evidence of pathology (43.8% of 16).—Durward Olds, C. R. Mochow, and James Rooney.

Effects of osmotic pressure on size of sperm cells.— Eight ejaculates from two bulls were used in hematocrit studies to determine packed cell volume. Placing sperm in 1.8% saline resulted in a 2.1% decrease in cell volume, whereas placing them in water caused a 9.8% increase in cell volume. Statistical analysis showed the differences to be highly significant; however, it was concluded that bovine sperm cells are very resistant to osmotic changes in size.—Durward Olds and Jerry Bruce.

Osmotic pressure affects appearance of bovine eggs.—Five bovine eggs were measured in normal saline and then transferred to 1.8% salt solution and or water. Hypertonic solutions caused a shrinkage of 6.3% in volume of the whole egg, but a 38.4% shrink in the vitellus. The watery (or hypotonic) solutions resulted in a 17.5% increase in volume of the entire egg, but an 80% increase in the vitellus. These changes occurred during a period of about 5 minutes. The perivitelline space was eliminated by swelling of the vitellus. Such eggs have been observed when freshly collected from slaughtered cows.—Durward Olds, C. R. Mochow, and Arthur Graden.

Measurements of bovine eggs.— Seventeen unfertilized eggs were recovered from the oviducts of repeat-breeding cows slaughtered 3 days after service. The outside diameters averaged 181.6± 21.8 microns, the zonas 13.0 ± 1.1 microns, and the vitelli 122.2 ± 6.3 microns. Among 24 fertilized eggs, it was found that 2-cell eggs averaged 181.8 microns, 4-cell eggs 174.4, and 8-cell eggs 165.0 microns.—Durward Olds, Arthur Graden, and C. R. Mochow.

Causes of fertilization failure in repeat-breeding cattle.— Studies of 98 repeat-breeding cows slaughtered three days after service indicated that ova did not get into the oviducts in 24.5% of the cases, and that there were oviduct obstructions in 11.1%, ovulation failure in 9.2%, abnormal ova in 4.1% and 15.3% were unaccounted for. Breeding late in the heat period produced 66.7% fertilization (considering only the cases in which ova were recovered) while among cows bred early, only 50% were fertilized.—Durward Olds, Arthur Graden, and C. R. Mochow.

Timothy vs. orchardgrass for dairy pasture.— First-year grazing trials comparing Clair timothy to Boone orchardgrass as a grazing crop for milking cows gave inconclusive results. The results, however, did indicate that Clair timothy produces forage relatively high in nutrients needed for maintaining milk production. The 4-week persistency average was 84.3%, though this was not significantly higher than the 78.6% average for cows grazing orchardgrass. No grain was fed to the cows on this trial.

The initial stand of orchardgrass was superior to that of timothy which was reseeded. The orchardgrass pasture contained fewer weeds. For example, the forage, sampled six times during May, June, July, and August, averaged 92% grass and 8% weeds for orchardgrass areas, and 81% grass, 18% weeds and 1% legumes for the timothy areas.

Following grazing periods, orchardgrass recovered faster than did timothy. This was especially true following the first grazing period.— D. M. Seath, W. C. Templeton, D. R. Jacobson, Tommye Cooper.

Dried skim milk in the calf starter for dairy calves.— Thirty-one 3-day-old Holstein and Jersey male and female calves were divided into two groups, weaned at 24 days of age and continued on calf starter and hay to 87 days of age. Both groups received starters that contained corn, oats, molasses, soybean oilmeal, salt, dicalcium phosphate, chlortetracycline, and vitamins A and D. One starter contained 200 pounds of dried skim milk per ton and the other none. Protein level was adjusted with soybean oilmeal. Data obtained for the dried skim milk and soybean oilmeal starter groups were: final weight, 214 and 200 lb; gain per day, 1.54 and 1.41 lb; milk consumption, 184 and 178 lb; starter consumption, 275 and 261 lb; hay consumption, 49 and 46 lb; TDN consumption, 276 and 246 lb; TDN above maintenance per pound gain, 1.52 and 1.51 lb. It was concluded that dairy calves can be satisfactorily weaned after a milk feeding period of three weeks when offered a simple but palatable dry calf starter and hay diet.— Fred Pardue, Don R. Jacobson, and Arthur Graden.

Effect of stage of maturity on feeding value of Tracy sorghum silage.— Three groups of cows were offered three rations, early milk stage Tracy sorghum silage, dough stage Tracy silage, and about half alfalfa hay and half early Tracy silage plus 20% protein concentrate. Persistency of milk production for each group in the same order as above was 89, 100, and 94%. Average dry matter intake per 1000 lb body weight was 14.4, 19.0, and 20.3 lb of roughage. For the milk and dough stage of maturity, TDN values were 61.6 and 65.9%, yields were 4.61 and 5.29 tons dry matter, or 2.84 and 3.49 tons of TDN per acre. Both of these are very high yields of nutrients per acre. This experiment suggests that Tracy sorghum silage cut at the doughy stage is superior to that cut in the early milk stage in every im-

portant respect.— Don R. Jacobson, Arthur Graden, and Robert Hatton.

Comparison of two newly bred strains of tall fescue and Kentucky synthetic orchardgrass.—This comparison was continued for the third year, the past grazing season (April 15 to October 27, 1961) even though considerable bluegrass and orchardgrass had volunteered into the experimental plots. Methods of handling the pasture and the animals were similar to the last two years. The average results were respectively for the 45-50 outcross, the three-family mixture of fescue, and the Kentucky synthetic orchardgrass (now named Boone), as follows: calculated TDN per acre, 2,444, 2,400, and 2,502; average daily gain, 1.44, 1.38, and 1.44; respiration rate per minute during August through October, 66, 78, and 58; body temperature during the same period, 103.0, 103.2, and 102.5. Data which are beginning to accumulate indicate that the toxicity present in tall fescue manifests itself through a reduced circulation causing dry gangrene in the extremities. This seems to be especially important during periods of cold environmental temperature. However, it causes an elevated body temperature and respiration rate during periods of very high environmental temperature.— Don R. Jacobson, Robert Buckner, Arthur Graden, Robert Hatton, Paul Burrus, and D. M. Seath.

A comparison of Kentucky bluegrass and Kentucky 31 fescue for dairy heifers.— This is the fourth year in which a comparison of fescue and bluegrass has been possible on the Coldstream farm experimental plots numbered 1 through 6. Due to an insufficient number of animals available, the Kentucky 31 fescue experimental plots were not grazed a year ago. Because of this and because the pastures were under-grazed during the current season, the results may have been influenced. The average results during the season (April 15 through September 23) for Kentucky bluegrass and Kentucky 31 fescue were in order as follows: calculated TDN production per acre, 1,640 and 1,688; average daily gain 1.34 and 1.38 lb per day; respiration rate per minute during August through October, 63 and 60; body temperature 102.4 and 102.7. These very limited data would preclude drawing conclusions.— Don R. Jacobson, Robert Buckner, Arthur Graden, Robert Hatton, Paul Burrus, and D. M. Seath.

Action of penicillin in reducing bloat.— Continuing studies on the mode of action of penicillin in preventing bloat have provided data which show that the fermentation rate of the rumen microorganisms is reduced when penicillin is administered during bloat conditions. The fermentation rate was measured as gas production per minute from strained rumen contents over a 90-minute period in Warburg apparatus. The rumen samples were obtained from fistulated animals stall-fed fresh, chopped, bloat-producing alfalfa. The difference in fermentation rate disappeared after 10 days of penicillin admin-

istration. Additional data on the relationship between stable froth formation and the incidence of bloat was obtained by grazing approximately 30 animals on a lush growing alfalfa during periods of high, medium, and no bloat incidence. Simultaneously, four experimental animals were fed forage chopped from the field. All rumen samples were obtained from these animals. There was a statistically significant gross correlation between the incidence of bloat and stable froth formation of rumen contents. There was also a very close relationship between gas production of rumen contents obtained at ½ hour after feeding and the bloat index.— William M. Miller, Don R. Jacobson, and Robert Hatton.

Bioassay procedure for determining level of toxicity in tall fescue or other grasses.— Previously, the development of dry gangrene in the extremities of the grazing animal (particularly in the tail) was taken as positive evidence of tall fescue toxicity. A more rapid method for checking toxicity was developed. The means for doing this was to measure the skin temperature at the end of the tail by attaching a thermocouple to the surface of the skin in such a way that the animal in a normal stanchion was completely unrestricted. A drop in skin temperature following administration of toxic material meant that circulation was reduced. Three animals received three different extracts (sub-fractions of the toxic fraction previously reported in the 1960 report). They were: fraction 1, aqueous phase less the alkaline chloroform soluble portion; fraction 2, the alkaline chloroform soluble fraction less the acid soluble portion; and fraction 3, the N/10 HCL soluble portion of the alkaline chloroform soluble fraction. One additional animal was included as a control. During the period of the investigation (January 1961) the mean difference between the tail temperature and the cold environment for the animal on fraction 1 was 8.6°C; fraction 2, 20.4°C; fraction 3, 21.7°C; and control 21.2°C. The difference observed for the animal receiving fraction number 1 was significantly lower than the difference for the other three animals. This indicates that the technique is sensitive to toxicity. The Northern Utilization Research and Development Division Laboratory ARS, USDA, Peoria, Illinois is continuing efforts to fractionate toxic forage still further.— Don R. Jacobson, W. M. Miller, Robert Hatton, Arthur Graden, and D. M. Seath.

ENTOMOLOGY AND BOTANY

Sheep nose bot control.— Forty-three lambs were treated with 5 organic phosphate insecticides for sheep nose bot control on November 30, 1961. The compounds used were Neguvon at 75 mg/kg (I. M. and drench), Famophos at 100 mg/kg (I. M. and drench), Teguvon at 5 mg/kg (I. M.), Dimethoate at 20 mg/kg (I.M.), and Co-Ral-Neguvon combination at 50 mg/kg (drench). Five lambs were in each treatment. Eight lambs served as controls. All treatments except Teguvon gave virtually a 100 percent control of nose

bots Teguvon gave 63% control. Neguvon (I. M.) and Co-Ral-Neguvon drench had one live 3rd instar larvae in each group. Most larvae found in the control and Teguvon animals were of the 1st instar. Each control animal averaged 19.1 grubs per head.— F. W. Knapp and H. Drudge.

Fly control on cattle and horses.— A field test with eight insecticides and five different formulations was conducted for face fly control on dairy and beef cattle and thoroughbred horses. Of the eight compounds, a new carbamate designated as B-39007 was most successful in controlling face flies on dairy heifers and cows when used as a 0.5% syrup smear. Up to two-week control of flies was achieved before weather conditions terminated the experiment. Syrup smears, however, are not entirely satisfactory as they attract flies to the animals. B-39007 used as a 3% smear (wettable powder + Pylac spreader + syrup + water) also gave the best results when used on horses. Although the flies seemed to be attracted to the smear, all that fed died instantly. The treatment was effective up to 8 days, at which time the weather terminated the test. No successful control of face flies on beef cattle was seen with 1% or 2% Korlan in fuel oil in back rubbers. Of all treatments dust formulations were the least effective for face fly control.

SD4294, a new phosphate compound, was very effective when used as a dust in controlling horn flies on dry dairy cows. Ten grams of 20% dust was applied to the backs of the animals. Control ranged from 83% to 100% for 17 days, whereupon the experiment was terminated due to the weather. Excellent horn fly control (98%) and partial face fly control (53%) was obtained by spraying dairy heifers with 1 ounce of Dow-1816 (Korlan, piperonyl butoxide and pyrethrin) daily. Indications are that only ½ of the animals in a herd would need to be treated for adequate horn fly control.— F. W. Knapp.

Horn fly, face fly, and house fly control with feed supplements.— A new organic phosphorous compound, Dow M-1651, and Trolene F. M. was fed to dairy heifers for controlling flies breeding in their droppings. Thirty animals were used in these tests. M-1651 was fed at 7.5 mg/kg/day for 14 days and 2.5 mg/kg/day for 28 days. Trolene F. M. was fed at 5 mg/kg/day for 28 days. Droppings were collected periodically throughout the test and bioassayed with two-day-old house fly larvae. As long as the animals were receiving the medicated feed both levels of M-1651 was equally effective (95-100%) in controlling house fly larvae. Trolene F. M. was only ½ as effective. Trolene F. M. reduced the number of adult horn flies feeding on the animals considerably whereas the M-1651 did not. This indicated no systematic action of M-1651. Adult face flies in this test were not numerous enough to draw any denite conclusions as to the effectiveness of the treatments. Indications are that all the horn flies and face flies seen on the treated animals had migrated from untreated animals as no fly larvae were found in any of the inspected droppings of treated animals.—F. W. Knapp.

Fogging of Vapona for household pests.— Two homes were fogged with 5% Vapona (DDVP) in fuel oil for control of cockroaches, silverfish, and spiders. The homes were closed for two hours and then ventilated. Complete control of all pests was accomplished. No damage to upholstering, furniture, floors, or walls was noted. A dog kennel was also fogged for control of brown dog ticks. No live ticks could be found two hours after treatment. The dog and surrounding run were treated with Korlan to prevent reinfestation.— F. W. Knapp.

Hypoderma lineatum in cattle (baby beef) gullets.— Gullets were collected weekly from slaughter animals starting July 31, 1961. The first grub found was August 2. This compares with first grubs found on July 9, 1959, and June 1, 1960. Most grubs were found in October and November in both 1959 and 1961. (No report available for June 1960.) The last sampling date for this report was on December 6, 1961. Six percent fewer gullets were infested in 1961 (an average of 1 grub less) than in the same period of 1959. Indications are that the grub seasonal cycle is becoming later and that the use of the new systemic insecticides is beginning to decrease the number of grubs in the state.— F. W. Knapp and H. Drudge.

Studies with mites.— Studies were continued in soybean resistance to the two-spotted spider mite attack. The technique involved bringing foliage from field plots into the laboratory, introducing mites to detached leaf disks and then counting the resulting progeny. The varieties Hill and Dorman were rated moderately resistant. A number of unnamed (plant introduction) varieties were more resistant.

Ecological studies were continued on sheep and cattle pastures, turf samplings being taken at various times of the day during the summer months. Certain oribatid mites, vectors of tapeworm in sheep, were found to be more common in the sheep pastures than in the cattle pastures, but macrochelid mites, a predator of the house fly egg, were found to be more common on cattle pastures. In fauna, more oribatids were found in the sheep pasture but more mesostigmatids were found in the cattle pasture.

Work is also under way in the areas of chemically defined diets for plant-feeding mites and in the evaulation of macrochelid mites as predators of the house fly egg. These projects are sponsored by the National Science Foundation and the National Institute of Health. — J. G. Rodriguez.

Studies on corn insects.— Continuing work begun in 1960 on studies of an over-all insecticide control program, soil applications were made during corn planting and superimposed on these treatments were various insecticidal foliar applications to control flea beetle, European corn borer, and corn earworm in various combinations. However, soil insect activity was very low as were populations of the other insects mentioned, and no significant differences in yield were obtained from the treatments.—J. G. Rodriguez.

European corn borer and corn earworm studies.—Work was conducted on European corn borer control using granular materials applied to 13 sweet corn hybrids in a test designed to give data on resistance to corn borer and to corn earworm. These plantings were made at the Woodford county farm and at the Spindletop farm. Neither location produced high enough infestation levels to give significant ratings or differences among hybrids or treatments.— J. G. Rodriguez.

Strawberry insect pest studies.— A field planted in 1960 was used to test the effectiveness of phorate, a systemic applied in granular form. Phorate was applied to small areas at 2 and 4 pounds per acre to selected plants that were transplanted mite-infested. Six weeks after plant transplanting a serious infestation existed on the check plots and within 2 weeks more the plants were so depleted of food value that mites had become scarce. The treated plots on the contrary contained a relatively high infestation at the end of 8 weeks, the population having developed slowly up to that time. Hence, the mites were depressed but not entirely killed by phorate granular applications.— J. G. Rodriguez and C. E. Chaplin.

Studies on vegetable insect control.— Broccoli, cabbage, potatoes, peppers, egg plant, lima beans, squash, and tomatoes were grown in replicated plots and these were treated with Sevin plus malathion, toxaphene plus malathion, perthane plus malathion, Thiodan, Zectran, Bayer 22408, or Dimecron 4 in a test of general performance against vegetable insect pests. Excellent control of flea beetles was obtained with toxaphene plus malathion combination (2 and 1 pound of each, respectively), and with Triodan at 0.5 pound per acre. Good control of cabbage worms was obtained with Thiodan at the same rate, but perthane plus malathion (1 pound per acre of each), and Zectran at 0.5 pound per acre gave excellent control. Toxaphene was not applied to squash because it is phytotoxic to cucurbits. The same materials or combinations of materials mentioned above, plus Dithane M-22 fungicide, gave significantly better yield of broccoli than the check, treated only with the fungicide. In cabbage, the yields were highest with Tiodan, toxaphene plus malathion, Zectran, and Sevin plus malathion, (0.75 plus 0.625 pounds per acre), in that order, but perthane plus malathion, Bayer 22408, and Dimecron were also all significantly better than the check. Production ranged from approximately 30 to 45 percent improvement over the check. Harvest yields of California Wonder peppers showed decreases in yields from all treatments, and Dimecron was significantly detrimental. Zectran and Dimecron improved lima beans yields by 71 and 68 percent, respectively; Sevin plus malathion by 18 percent, these being the extremes of the range. Improved yield in tomatoes ranged from 13 percent on perthane plus malathion to 123 percent on Sevin plus malathion. Potato yields were improved by insecticidal and fungicidal treatment ranging from 82 to 123 percent over the check. Heavy flea beetle infestation dramatically cut egg plant yields, and the improvement

over the check ranged from approximately 11 to 30 times, Zectran being the most effective. Perthane plus malathion and Thiodan yielded a range of 12 to 60 percent over the squash treated only with fungicide.— J. G. Rodriguez and Dean Knavel.

Phytotoxicity of foliage treatments to tobacco.— A phytotoxic emulsifiable concentrate containing no insecticide was sprayed on tobacco in the field at different rates, dilutions in water, and at different distances from the plant. Leaf burning was increased by the following: increasing the rate of application, decreasing the lilution in water, and decreasing the distance from the spray nozzle to the plant. Bud burning was caused by holding the nozzle close to the plant and using a heavy overdose of the material. Increasing the amount of water decreased the amount of leaf or bud injury in all instances.

Sevin as a dust, wettable powder, or flowable formulation caused damage to very small plants in the plant bed when used at two to four times the recommended rate. These treatments caused malformed leaves with granular leaf surfaces. Similar injury was not found when larger tobacco in the bed and in the field was similarly treated. None of the new compounds tested for control of tobacco insects caused any noticeable injury to plants in the field.— Richard Thurston.

Resistance of tobacco to insect pests.— Plants selected in 1960 for resistance to the green peach aphid were selfed and crossed with burley varieties. Their progenies were evaluated in 1961 in several field and greenhouse tests with promising results. Selections were made of resistant plants from most of these selfings and crossings. Most of the resistant lines tested in the field had few or no aphids on the young top leaves but had heavier infestations on the bottom, senescent leaves. Analyses of the infested bottom and uninfested top leaves from some of these lines showed a higher glucose content in the bottom leaves than in the top leaves. Analyses of leaves of resistant and susceptible plants did not show a correlation between resistance and low glucose content except with the resistant wild *Nicotiana* species. In the fall under shaded conditions, aphid resistance was not as high as in unshaded areas. In the greenhouse aphid populations built up much faster on the bottom leaves than on the top leaves of resistant varieties. Representative non-burley U. S. tobacco varieties tested in the field showed wide variability in aphid susceptibility, similar to that of the burley varieties. Graftings of resistant species on susceptible burley and reciprocal graftings did not change resistance or susceptibility in the scions or stocks.— Richard Thurston.

Biology of tobacco insects.— Populations of hornworms and budworms were low in 1961, but aphid and flea beetle populations were generally high. Very few budworms were found in central Kentucky until after most of the tobacco had been cut. Of the budworms attacking tobacco in the field, 91% were *Heliothis zea* and 9% were

H. virescens. Three percent of the field-collected budworms were parasitized.

Light-trap collections of hornworm moths were very light in 1961 compared to 1959 or 1960, with approximately half as many caught as in either 1959 or 1960. The pattern of catches was the same this year as in the previous two years except that the peak of emergence came 10-14 days later than in the other two years. Seventy-seven percent of the moths were *Protoparce sexta* and 23 percent were *P. quinquemaculata*. Eighty-four percent of the moths were males. None of the females examined had completed egg laying. Of 1465 hornworm larvae examined in the field in September and October, 17 percent were parasitized by *Apanteles congregatus*. In September 98.6 percent of the hornworm larvae were *P. sexta*—a much higher percentage than of *P. sexta* adults in light-trap catches.

The effect of temperature on green peach aphid was studied in constant temperature chambers in the greenhouse. Prolonged tempratures of 94-96° F appear to kill most of the aphids. A temperature of 100-102° F killed most of the aphids within a period of three hours. The aphids became abnormally active and stopped feeding almost immediately upon being placed in a chamber at this temperature.—Richard Thurston.

Control of tobacco insects.— In five field tests for control of tobacco flea beetles, DDT appeared to be the best material of those used with Sevin, cygon, and guthion also giving good control. Endrin, thiodan, diazion, and TDE were slightly less effective in the order listed. None of the materials when sprayed from above the plants gave adequate control of flea beetles attacking half grown to mature tobacco. *Bacillus thurigensis* was not effective against either flea beetles or the green peach aphid.

The following materials gave as good as or better control of green peach aphids than malathion, a standard insecticide: SD3562, cygon, metasystox, Niagara 5767, and phosphamidon. Diazinon and thiodan were slightly less effective than the materials mentioned above but were about as effective as malathion on a single treatment basis. Thiodan at 8 oz and endrin at 4.8 oz per acre applied every 10 days gave excellent control of aphids, but endrin at 1.6 oz per acre was not effective. Plots treated with Sevin at 12 oz per acre every 10 days were almost ten times as heavily infested as untreated plots.

Of several new materials tested for control of hornworms, only American Cyanamid Compound 13064 appeared promising. Richard Thurston.

HOME ECONOMICS

Ascorbic acid in strawberries and snap beans.— Strawberries irradiated at 200,000 rad and stored at 35° F for 6 months contained 30mg/100g total ascorbic acid, nonirradiated strawberries stored under similar conditions contained 31mg/100g, and frozen strawberries contained 34mg/100g. Increasing the radiation dosage to 800,000 rad lowered the ascorbic acid content only slightly. Most

samples contained somewhat less ascorbic acid after 6 months in refrigerated storage than after 1 or 3 months.

Of ten snap bean varieties analyzed, Sconce, Improved Tendergreen, and White Half Runner contained the highest amounts of total ascorbic acid when freshly picked. Total ascorbic acid of all varieties was within the range of 12 to 23mg/100g. After processing and 9 months' storage at 0° F, the range was from 5 to 10mg/100g. Best retentions were seen in Corneli 14 with 67% of the fresh ascorbic acid content; Wade, with 60%; and White Half Runner with 56%. Other varieties retained smaller percentages of their fresh ascorbic acid content. Total ascorbic acid in all varieties tested decreased as successive analyses were made at 0, 3, 6, and 9 months, even though all samples were held at 0° F.— Doris A. Tichenor, Claudia E. Wells, and Dudley C. Martin.

Evaluations of frozen vegetables.— In cooperation with Horticulture Department; see page 53.)

A comparison of working wives with nonworking wives in food shopping and preparation attitudes and practices.— Working wives in Louisville spent less money per person meal for meals eaten at home than did nonworking wives. The difference was small, but it shows that working wives do not use more of the expensive, ready prepared and "convenience" foods than do nonworking wives. Working wives showed a tendency toward being more economy-minded in food management. More of them used dry and evaporated milk. Both groups used the same amounts of whole milk, cottage cheese, and ice cream. Over one-fifth of the working wives in the study were the principal wage earners for their families. Forty-seven percent of the working wives had some or all children 12 years of age or under. Ten percent had all teenagers. Forty-three percent were part of all adult families.— Mildred R. Wightman and John B. Roberts.

HORTICULTURE

Tomato fruit cracking.— Nutrient culture research over a 2-year period has indicated that tomatoes which are grown under a regime of variable daily moisture are less likely to crack when the plants are supplied with boron above the deficiency level (.10 PPM or more) and potassium sulfate as a source of potassium. Preliminary results from experiments to determine the reason for these effects suggest that the effect of their nutrients on transpiration is involved.— D. J. Cotter.

Internal browning and blotchy ripening of tomatoes.— An experiment was conducted in the spring of 1961 to determine the influence of anions (potassium chloride vs. potassium sulfate), tobacco mosaic virus (TMV), and seven levels of boron on internal browning and blotchy ripening of tomatoes.

Blotchy ripening incidences were higher when the chlorine source of potash and threshold deficient levels of boron (.025 or .05 PPM) were used. Tobacco mosaic virus infections did not significantly affect

the blotchy incidence. The results with boron were in conflict with results obtained previously and research is continuing to substantiate them.

Browning in the fruit wall (internal browning) was affected by the boron treatments only. The deficient boron treatment (0.125 PPM) resulted in a higher percentage of fruit affected and more severe symptoms. Anion and TMV treatments were not effective in modifying the internal browning occurrence.— D. J. Cotter.

Pickling cucumber research.— The third year of results concerning the determination of fertility and plant spacing of pickling cucumbers was completed in 1961. Nitrogen, 20 or 40 pounds per acre applied at planting, did not significantly increase yields when compared to no-nitrogen checks. Potassium fertilization results indicate that yield responses of 80 pounds compared to 40 pounds K_2O A can be expected when the soil test shows less than 80 pounds K per acre.

Plant spacing of 9″ in the row was superior to spacing of 12″ or 18″ when total yield and income were compared. However, under certain conditions, the increased yield or value did not compensate for the increased time necessary to harvest the crop.— D. J. Cotter.

Evaluations of frozen vegetables.— Vegetables frozen in 1960 were evaluated during the fall, winter, and spring of 1960-61. Taste panel ratings and objective quality measurements were made on varieties of broccoli, snap beans, Blue Lake pole beans, small-seeded lima beans, and sweet corn. The number of varieties tested and the best two or three were as follows:

Broccoli: (8) Waltham 29, DeCicco, K&V
Snap Beans: (10, Corneli 14, Tenderwhite
Blue Lake Beans: (4) Stringless #231, Stringless #228
Lima Beans: (5) Utah 16, Wasatch Bush
Sweet Corn: (8) Gold Cup, #27802, Iochief

In the gamma irradiation studies sweet corn continues to show the most promise as an acceptable product. Canned samples of whole kernel corn subjected to pasteurizing dosages of gamma rays and held at 35° F for nine months were still acceptble to a taste panel. Excluding oxygen from the can by the use of nitrogen gas or a glucose oxidase packet was beneficial. Analysis of irradiated corn samples for total sugar and reducing sugars showed little change from the initial sugar content, while non-irradiated (35°F) samples lost nearly all their sugar. Work is continuing with irradiated strawberries, but so far no combination of treatments has approached the quality of frozen strawberries.

Preliminary microbiological evaluations of irradiated sweet corn and strawberries indicate population of yeasts, molds, aerobic bacteria, and anaerobic bacteria are no higher than in frozen control samples.— Dudley C. Martin and Doris A. Tichenor.

Ascorbic acid in strawberries and snap beans.— (In cooperation with Home Economics Department; see page 51.)

Variety testing of vegetables for processing.— Replicated plantings of several crops were grown in 1961. The crop, number of varieties grown, highest yielding varieties, and the best yield in pounds per acre are given in the following list:

Small seeded lima beans (7): Allgreen (8,300) Thaxter, Nemagreen.
Blue Lake pole beans (6); Stringless #231 (18,000) Stringless S-7.
Spring Cabbage (7): Bonanza (54,900), Marion Market.
Fall Cabbage (16): Glory 61 (44,800), Greenback YR, Badger Ballhead, Marion Market.
Fall Broccoli (11): Early K&V (8,040), Hybrid #10, Coastal, Atlantic.
Fall Cauliflower (9): Snowdrift (18,700), Snowball A, Snowball X.

— Dudley C. Martin.

Strawberry breeding.— Twenty-nine selections from the Kentucky breeding program and three USDA selections in replicated plots fruited and were evaluated for horticultural characteristics and also as frozen products. Fifteen of these were retained for further testing.

From the 1958 crosses 225 selections were planted. Two of the crosses involving Kentucky selections produced outstanding progeny.

A new breeding system (polygenic) was used this year for the first time. Twenty-one of the best Kentucky selections were used to furnish a homogenous mixture of pollen. The same 21 selections were then fertilized with the pollen. Approximately 75,000 seed from these crosses have been planted. They will be innoculated with leaf spot and scorch in the seedling beds in the greenhouse and only resistant selections will be planted in the field.— C. E. Chaplin.

Strawberry variety testing.— Twelve varieties of strawberries were tested at Lexington and 13 at the Eden Shale farm. Production and quality were excellent. The top varieties at Lexington were Sure Crop 549 C.P.A., Dixiland 535 C.P.A., Pocahontas 472 C.P.A., Armore 464 C.P.A., Red Glow 456 C.P.A., Early Dawn 441 C.P.A., Blakemore 439 C.P.A., Tennessee Beauty 431 C.P.A. This was the first time that Tennessee Beauty has been out of the top five in production. One of those in the top five, Armore, is too soft for commercial plantings.

Production at the Eden Shale farm was even higher than at Lexington. The top varieties there were as follows: Dixiland 859 C.P.A., Blakemore 711 C.P.A., Armore 678 C.P.A., Red Star 670 C.P.A., Pocahontas 597 C.P.A., Sure Crop 557 C.P.A., Tennessee Beauty 533 C.P.A. Dixiland, Armore, and Pocahontas were in the first five at both locations but not in the same order. Tennessee Beauty was not in the top five at the Eden Shale farm for the first time.— C. E. Chaplin.

Strawberry insect pest studies.— (In cooperation with Entomology and Botany Department; see page 49.)

Blueberries.— Growth measurements were made on three blueberry varieties receiving varying amounts of nitrogen, alone and in combination with potassium chloride and potassium sulfate and with a complete fertilizer. No significant differences due to treat-

ment, were found after two years in average growth, height, or width. However, the measurements showed that Berkley makes a higher and wider bush than either Herbert or Coville. It was also the highest producer.

Birds continue to be the Number 1 pest of blueberries. An automatic carbide gun which was effective in protecting the fruit last year failed to protect it this year.— C. E. Chaplin.

Flowering of orchids.— One plastic greenhouse containing approximately 300 blooming-size Cymbidium plants was maintained and flowering and growth records taken for the season. Plants to be used in clonal work were divided and established for sampling at a later date. Samples were taken from plants at weekly intervals and the leaf and pseudobulb analyzed for mineral nutrients. Additional samples were frozen for growth substance extraction and determination.

Bioassay of growth substances within the plant has not been successful to date.— J. W. Abernathie.

Keeping quality of flowers.—Materials were obtained, including a walk-in refrigerator and various testing instruments, and an apparatus constructed for determining respiration on cut flowers under conditions simulating commercial storage facilities. Several types of cut flowers were tested at various times of the year to determine the pattern of post-harvest respiration. No clearcut over-all patterns were obtained.

Rose plants and carnation plants were established in greenhouses so that freshly cut blooms will be available throughout the year. Various other types of cut flowers were used, but roses have given the best results to date.— J. W. Abernathie.

Black rasperries.— The spring of 1961 developed an unusual set of conditions which caused very poor fruit set on black raspberries. At Lexington they were in full bloom by May 15. Within two weeks after the full bloom period, it became evident that many of the individual flowers had withered and failed to set fruit. Counts were made to determine the exact number of blooms which had set fruits and also the ones which had failed to set. In none of the cases were killed parts found, so it was decided to examine the temperature records to see if there was any other explanation for the unusual happening.

From both observations and the data collected, it appeared evident that the principal cause for the failure of fruits to set was temperature conditions which were not low enough to actually cause tissue damage but were low enough to prohibit bee activity and pollination.

Different fungicidal sprays were used on replicated plots of each of the tested varieties during the summer of 1959, but no correlation was found between spray treatments and the amount of blooms which failed to set fruit.

The fruit harvesting period consequently was short, as expected,

and the comparatively small number of berries which developed were all harvested in just four pickings. Yields for 1961 and 1960 in 24-pint crates per acre were:

Variety	*Yield–1961*	*Yield–1960*
Bristol	86.9	360.0
Cumberland	71.2	223.0
New Logan	42.2	263.6

The reduction in yields was directly in line with the percentage of dead blooms determined by the blossom counts.

At the Eden Shale farm yields were somewhat better (Bristol, 138.2 crates; New Logan, 116.0 crates) except for Cumberland (54.0 crates). The low yield from Cumberland at the Eden Shale farm was apparently due to serious virus infection, more severe on Cumberland than on the other two varieties.—C. S. Waltman.

Red raspberries.— The following recorded yields for 1961 and 1960 show the results of fungicidal treatments upon cane growth. The sprays were applied during 1960 and 1959.

Fungicide Treatment	*Fruit Yield 24 pt. crates per acre*		*Yield per foot of cane (pints)*	
	1961	*1960*	*1961*	*1960*
Thylate	400	655	0.094	0.19
Zineb	380	548	0.106	0.16
Captan	379	579	0.095	0.18
Ferbam	349	191 (Phix)	0.092	0.07 (Phix)
Checks (No sprays)	318	496	0.091	0.14
Manzate	313	486	0.085	0.13
Dyrene	298	515	0.079	0.16
Cyprex	298	411	0.090	0.11

Although yields were lower this year than in 1960, effectiveness of the spray materials was very similar; Thylate, Zineb, and Captan gave best results; Ferbam which replaced Phix about the middle of the 1960 season ranked fourth in yield this year. Three of the sprayed plots failed to equal the unsprayed checks in yield, although the differences were not great enough to be significant.— C. S. Waltman.

Forest planting and forest management studies in the Eden Shale area.— Studies on survival and height of the 1956, 1957, and 1958 Christmas tree plantings are summarized in the following table (Scotch Pine only).

Year	*No. Planted*	*1961 Survival*	*Survival %*	*Av. Height*	*S x*
1956	7,000	4,611	65.87	38.5″	.52″
1957	7,000	5,001	71.44	32.1″	.28″
1958	7,000	3,613	51.61	20.0″	.32″

Rainfall in the above years being somewhat comparable, a tentative conclusion might be advanced that the drop in survival and height of the 1958 planting can be attributed to pre-planting site preparation. The 1956 and 1957 areas were hand cleared whereas the 1958 was bulldozed with resultant compaction, puddling and loose fills.

The plantings to date include Douglas Fir, Norway Spruce, Arizona Cypress, Mexican Cypress, White Pine, Red Pine, Virginia Pine, Austrian Pine, and 11 strains or selections of Scotch Pine. Douglas Fir, Norway Spruce, and White Pine have been almost complete failures.

Observations indicate that shearing must start the third growing season after planting if tree form quality is to be controlled. Shearing time for 13,225 trees was approximately 300 man hours or slightly less than 1½ minutes per tree. The 1961 records indicate land clearing costs in heavy wooded cove run about $43 per acre. Planting requires 20 man hours per 1,000 trees.

The use of a color in stump and cut stub sprays (to reduce sprouting) facilitated coverage of all stumps.

Clear plastic over black plastic mulch, for vegetables.— When a clear¾ mil layer of plastic was placed over black mulch laid in the usual way and a dead-air space was maintained between the two layers, snap beans were forced much earlier than when black alone was used, as shown by

SNAP BEANS

Treatment	*Early Yields (Bu. per acre)*	*Total Yields (Bu. per acre)*
Check	25.8	143.5
Black	63.9	355.8
Black + Clear	224.6	421.5

These large increases show the warming power of the double layer early in the spring. Fortunately, the thin, clear plastic soon disintegrates and the black alone remains. The clear thus stays just long enough to give the initial stimulus and then when it starts to get too hot it breaks up.

When plastic is placed over lima beans, which are very sensitive to cold crusted soils, the warmth and non-crusting results in much better stands. This is true in the early spring and even later helps in preventing crusting by hard rains.

LIMA BEANS

Treatment	*Yields in bu/acre*
Check	6.2
Black plastic	158.5
Black + Clear	221.6

The stand was poor on the check, which accounts for the extremely low results.

Sweet corn does not have as much difficulty in coming up early, but it responds well to the warmed soil.

SWEET CORN (per acre)

	Earliking			*Gold Rush*		
	Early Yield			*Early Yield*		
Treatment	*No. Ears*	*Wt., lb*	*Total Yield Wt., lb*	*No. Ears*	*Wt. lb*	*Total in lb*
Check	0	0	5,040	0	0	8,680
Black Plastic	53	1,374	5,973	0	0	7,746
Black + Clear	82	2,126	7,591	63	1,634	9,302

On black plastic alone, Earliking produced fair early yield with black plastic alone, but was much higher with clear over black. Gold Rush produced early only when clear was used over black. Clear over black produced the highest total yields in all cases, showing that rapid early growth ups total yields as well as early yields.

Clear plastic over black showed increased early yields of Valiant tomatoes. However, total yields were not so much higher than the check, although those protected by plastic over wire from the start gave the highest total yields.

VALIANT TOMATOES

Treatment	*Early Yield, Tons per-acre*	*Total Yield, Tons per acre*	*Early Size, lb per fruit*
Check	.44	16.8	.306
Black plastic	1.18	15.5	.398
Black + clear plastic	2.32	18.5	.336
Black + Clear on wires	3.41	21.1	.380

—E. M. Emmert

Hormone boron and fertilizer dusts on tomatoes in plastic houses.—The following table gives results, as compared to those of the vibrated check.

Treatment	*Lb per plant, Early plant average*	*Lb per fruit, Fruit size*
½ Reg. + Reg. 3 times	1.36	.442
Reg. + 20-20-20 + Dextrose	.90	.527
Reg. + Dextrose	1.04	.422
Reg. + 20-20-20 + Dextrose	.90	.527
Vibrated Check	.53	.346

* Reg. = The regular dust concentration of polybor and beta naphthoxyacetic acid.
** = A complete soluble fertilizer of 20-20-20 concentration.

While addition of fertilizer did not increase yields over those from hormone boron alone, it did cause increased fruit size. Use of harmone boron nearly tripled the yield over that from vibration alone. —E. M .Emmert.

Effect of growth regulator and foliar applied nutrients on field tomatoes.— The early results on the plots dusted with growth regulator (BNA beta naphthoxyacetic acid) and fertilizer showed significant increases far above the 1% level of significance, and the sprayed plots were near the 5% level. This shows that fertilizer, boron-BNA-sugar dusts will give large early yields. The boron-BNA without the fertilizer gave good increases also for the dust and smaller for the spray, but not as large as when fertilizer was included. The BNA fertilizer dust gave significant increase on total yields but the spray total increases were not significant. Both early and total yields were influenced most on the Valiant variety, the differences being of the same order but not as great on the Marglobe variety. Valiant gave much larger early yields than Marglobe and was about the same on total yields.—E. M. Emmert.

Development and evaluation of varieties for vegetable production in Kentucky.— Screening and selecting of tomato varieties for resistant to verticillium wilt, fusarium wilt, gray leaf mold, and nematodes were continued in greehouse types. Selections of snapbeans were continued in the F_3 and F_4 population of lines for a bush type White Half Runner. A polycross system of breeding was initiated in pickle cucumbers.— D. E. Knavel.

Grafted tomato stock and scion studies.— Grafting verticillium-susceptible varieties onto resistant rootstocks was found to be a technique to produce a crop of tomatoes in verticillium infested soils where susceptible varieties failed. Studies are continuing in the greenhouses on the organism's movement through the grafted plant and stock-scion inter-relationships.— D. E. Knavel.

Evaluation of vegetable varieties for production in Kentucky.— At the Eden Shale and the Lexington Experiment Station farms replicated and observational trials were conducted on the following:

Tomatoes	61 varieties and breeding lines.
Snapbeans	28 varieties and breeding lines.
Sweet Corn	66 varieties and breeding lines.
Pickle (Cucumber)	22 varieties and breeding lines.

The following were outstanding varieties:

Tomato	STEP 346 and Marion
Snapbeans	Wade
Sweet Corn	Midseason, KCF 58-10; early Seneca Dawn
Cucumber	MR-17 and SC8M1

An experiment was conducted to find new crops for production in field greenhouses with different systems of trapping solar heat. Temperatures were recorded. Leaf lettuce did well under all systems. Spinach, kale, parsley, onions, and radishes produced well in the house where day and night temperatures remained cool.—D. E. Knavel and E. M. Emmert.

Pot size and spacing for growing tomato transplants for variety trials.— An experiment was conducted to find the best pot size and spacing for growing tomato transplants prior to field setting. An 8-inch spacing in a 4-inch peat pot outproduced all other kinds.— D. E. Knavel.

Forestry conversion.— Fenuron pellets at rates of 10, 15, 20, and 25 lb A gave effective control of overstory and understory hardwood growth. Many plots were still suitable for planting shortleaf pine three growing seasons following treatments. Fenuron at all rates used did not appear to cause injury to shortleaf pine planted two years following treatments. Fenuron can be successfully used for converting undersirable hardwood forests to desirable shortleaf pine plantings on sandy loam soils in Kentucky.—J. W. Herron.

Vegetable weed control.— Eighty-five herbicide treatments were applied to five vegetable crops. Chemicals that either warrant further testing or are being recommended for use in vegetables are as fol-

lows: (Herbicides underlined are those recommended for 1962.)

Snapbeans .....*DNBP, CDAA-T, CDEC*, Diphenamid, Amiben, Eptam, Tillam, Casoron.

Tomato Transplants .....*CDEC*, Diphenamid, Tillam, Dachthal, Amiben, Simazine, Casoron, Stauffer 1856, Stauffer 1870, Stauffer 3415, Niagara 6370, Trietazine.

Peppers .....Simazine, Amiben, Diphenamid, Eptam, Tillam, Stauffer, Casoron, Dacthal, Vegedex.

Cabbage .....*Vegedex*, Casoron, Stauffer 3415, Stauffer 1856, Stauffer 1870, Stauffer 3400, Zytron, Amiben Diphenamid, Dacthal, Tillam.

Cucumbers .....*Alanap*, Vegedex.

— J. W. Herron and D. J. Cotter.

Weed control in strawberries.— Treatments with different rates of Sesone, Amiben, Trietazine, Tillam, Eptam, Zytron (granular), Niagara 6370, and Dacthal were applied on new plantings of Pocahontas strawberries. All of the herbicides showed considerable merit and warranted further testing. Sesone will continue to be recommended for 1962. Eptam will carry an experimental label in 1962 and will be recommended for use on a trial basis for commercial production.— J. W. Herron and C. E. Chaplin.

Weed control in ornamentals.— Approximately 75 varieties of woody ornamentals were treated with simazine and propazine at the rate of 2 lb/A (active ingredient). Final phytotoxicity results on the crop plants will not be obtained until the spring of 1962. Better weed control was obtained from the simazine treatments than from the propazine treatments.—J. W. Herron.

Weed control in turf.— Several chemicals were tested as pre-emergence treatments for crabgrass control. Materials now being recommended for pre-emergence control of crabgrass are Dacthal, Zytron, and calcium arsenate. New pre-emergence herbicides that showed promise and warranted further testing were Trifluraline, Bandane, Niagara 6370, and Calcium Propyl Arsonate. Stam showed considerable promise as a post-emergence herbicide for controlling crabgrass and chickweed.

Liquid Zytron will be recommended for post-emergent control of nimblewill. Banvel D also showed promise for selectively controlling nimblewill in bluegrass turf. Neither herbicide at the applied rates caused injury to Kentucky bluegrass.— J. W. Herron.

Effect of gibberellic acid on the keeping quality of Easter lilies.— Gibberellic acid was applied to Easter lilies at intervals of two weeks until two days before flowering. On three varieties (Croft, Ace, and Nellie White) the treatment resulted in a significant increase in keeping quality as measured by petal wilt and browning.

Gibberellic acid at 500 and 1,000 parts per million was most effective, and the effects extended 6 to 9 or 9½ days. Length and width of flowers were not affected by the treatment. Stage of development at time of treatment did not influence the effectiveness of treat-

ments. All varieties responded favorably to treatment.— James D. Kelley.

Plant propagation and photoperiodism.— Stock plants of *Pyracantha coccinea lalandi* and *Viburnum juddi* were grown at five levels of nitrogen fertilization and three photoperiods, 10, 16, and 22 hours of light. Cuttings were taken from the stock plants and rooting response determined. Photoperiod did not influence the rooting of either species.

The nitrogen content of leaf samples from stock plants of pyracantha increased as the nitrogen fertilization level increased. Nitrogen content of the leaf had very little influence on rooting response except at the high level. The reducing sugar content of the leaves decreased as the level of nitrogen fertilization increased. Cuttings containing the lowest level of reducing sugars rooted best. Photoperiod treatments did not influence the chemical composition of the leaf samples.— James D. Kelley.

POULTRY SCIENCE

Effects of selection and inbreeding on broiler body weight.— Selection and inbreeding experiments have been started, using a randombred strain maintained at the Southern Regional Poultry Genetics Laboratory for base stock and control stock. Mass (individual) selection for 8-week weight indicated a heritability of about 27 percent for this characteristic. Parents which averaged 151 grams heavier than the mean of their generation produced progeny which averaged 42 grams heavier than unselected randombred controls.

Inbreeding depression is evident among the inbred lines started from the same randombred strain. Full brother to sister mating has been used exclusively. In Series A (parents 37.5 percent inbred) only five lines remain from eight started. The 8-week body weights of the survivors ranged from 100 to 130 grams lower than randombred controls. In Series B (parents 25 percent inbred) seven lines remain from eight started, and survivors range from 25 to 55 grams lighter than controls.— D. W. MacLaury, T. H. Johnson, and W. M. Insko, Jr.

Calcium and antibiotics on cage laying diets.— In an effort to improve egg production and egg shell quality in yearling hens a trial was conducted in individual laying cages. The test diets were formulated using two levels of calcium (2.5 and 3.75 percent) with and without 100 grams per ton of an antibiotic mixture of streptomycin and procain penicillin. Four replicate groups of 10 hens each were fed each diet.

The experimental results after six months on the test diets showed that neither increasing the calcium level nor supplementing the diet with an antibiotic mixture had any significant influence on rate of production, egg shell thickness, interior quality, mortality, or feed per dozen eggs.—John J. Begin and W. M. Insko, Jr.

Effect of protein source on chick growth.— A battery trial was conducted to determine the value of supplementing a corn-soybean

meal diet with equivalent amounts of protein from either fish meal or meat scraps alone or in combination. The value of methionine supplementation of the corn-soybean meal basal was also studied. Broiler strain male chicks were used with 5 replicate groups of 10 chicks each being fed the experimental diet.

The results indicated that no significant differences were obtained between the corn-soybean meal basal and any supplement when measured by either growth response or feed utilization.— John J. Begin.

Effect of temperature and absolute humidity on contamination of eggs.— Ambient atmospheric conditions on the day that an egg is laid apparently influence the likelihood that the egg will become contaminated by contaminating bacteria in the nest. When 981 eggs were cultured to determine the presence or absence of contaminating bacteria after being laid in contaminated nests, significant positive gross correlations were found between bacterial recovery rate and the atmospheric variables of temperature, absolute humidity, and vapor pressure. Under the conditions of this study the estimated correlations between recovery rates and relative humidities were not significant.— D. W. MacLaury and W. M. Insko, Jr.

Effect of antibiotics and arsenicals on growth.— The influence of dietary antibiotics and arsenicals on growth response in chicks is being compared with the effects of these compounds on the tissues of the small intestines. Thus far, observations show that chicks getting these materials have small intestines that are slightly shorter and weigh less than the small intestines from chicks not getting antibiotics or arsenicals in the diet. The small intestines from chicks showing a growth response to these compounds have thinner walls, especially in the lower portion, than the intestines from chicks not on treatment.— O. J. Abbott and W. M. Insko, Jr.

Effect of energy restriction on pullet development.— A trial was conducted to obtain information concerning the effect of changes in the energy level of the diet on pullets of various ages.

Three hundred day-old White Leghorn pullets were divided into two groups. One group was fed a high energy diet containing 940 calories of productive energy and the other group a diet containing 706 calories per pound. At eight weeks of age, the pullets were weighed individually and each original group was subdivided into two groups. One of the new subgroups was continued on the same energy level diet as before and the other subgroup was fed the opposite energy level diet. At 18 weeks the pullets were again weighed individually and placed in individual laying cages.

The data obtained at 8 and 18 weeks indicated that the feeding of low energy diets at any age significantly reduced growth. There was also an increase in feed consumption when the low energy diet was fed. There was no evidence of any delay of sexual maturity nor

any increase in egg size measured when 25 percent production was reached. Mortality was low in all groups.— John J. Begin and W. M. Insko, Jr.

RURAL SOCIOLOGY

Trends in use of recommended farm practices.— Farmers in 12 neighborhoods of a county in the Outer Bluegrass were surveyed in 1950, 1955, and 1960 as to their use of 14 recommended farm practices. Practices that gained in use in each five-year period were soil testing, terracing and/or contouring, plowing tobacco beds in the fall, using Methyl Bromide gas on tobacco beds, using commercial fertilizer on corn, growing Kenland red clover, growing alfalfa, using artificial breeding, and keeping records of receipts and expenses. However, by 1960 the only ones of the 14 practices that were being used by more than half the farmers were soil testing, fertilizing corn, and keeping records. Recommended practices that reached stability or declined in use after 1955 were bluestone-lime on tobacco beds, calf vaccination for brucellosis, phenothiazine in salt for sheep, phenothiazine drench for sheep, and keeping an all-pullet flock.

In neighborhoods of relatively high education, the use of recommended practices was 10 years or more in advance of the use level in neighborhoods of low education—considering only the practices that gained in use during the decade. The scale of farming and the use-suitability of the land characterizing the neighborhoods also were associated with the pace at which farmers had begun using these recommended practices.— C. M. Coughenour.

Trends in use of farm information media.— Use of various farm information media in an Outer Bluegrass county generally increased between 1950 and 1955 but declined between 1955 and 1960. Only radio and television retained or increased their audiences in each period, while the use of most of the following media declined between 1955 and 1960 to near the 1950 levels: Farm magazines, newspapers, farm meetings, agricultural agency representatives, circular letters, farm bulletins, and dealers and salesmen. The data were obtained by field survey in the same 12 neighborhoods in 1950, 1955, and 1960.— C. M. Coughenour.

Education and adjustment among migrants and non-migrants.— Analysis of data obtained from a 1960 follow-up of young men who were in the 8th grade during the 1949-50 school year in eleven Eastern Kentucky counties revealed that: (1) those who are presently residing in Southern Ohio are doing considerably better financially and have a higher level of living than those who still live in Eastern Kentucky; (2) amount of schooling is positively related to level of living and occupational prestige status in the case of non-migrants; (3) in the case of migrants, no significant relationship between education and measures of socio-economic status was revealed. As expected, however, education was found to be positively associated with various indices of social integration, such as participation in organizations,

residence mobility, and satisfaction with community, in the case of both migrants and non-migrants. One conclusion that can be drawn from these findings is that the opportunity structure of the region in which a young man pursues his career has a great deal to do with determining his life chances.— Harry K. Schwarzweller.

Evaluation of population estimate methods for counties.— An evaluation was made of the U. S. Bureau of the Census method for estimating the populations of small areas (Method II). Population estimates for Kentucky's counties on April 1, 1960, made by Method II, were compared with the census count on this date. Most estimates were higher than the census counts, probably because of distortion produced by heavy out-migration. However, estimates for three-quarters of the counties were within 10 percentage points of the actual census count; for half the counties the estimates were within 5 percentage points.

Attempts to secure greater accuracy by using correction factors for migration based on past migration rates for the school-age population in state economic areas were not fruitful. Attempts to shorten the method by omitting factors which adjust the county populations to the state estimate were found to decrease the accuracy of the estimate. A study of the counties where estimates deviated most from the census figures showed heavy population changes in the adult population of these counties between 1950 and 1960, particularly the population 20-54 years of age. Since the estimate method depends heavily on the school-age population and its relation to the total population, there is a need for other indexes which would be more sensitive to changes in the adult population.— George A. Hillery, Jr.

Population growth in Kentucky's counties, 1820-1960.— Because there were numerous changes in county boundaries during the nineteenth century, counties of similar socio-cultural characteristics were grouped into four regions for this study: Purchase (Economic Area 1), Western (approximately Economic Areas 2, 3, and 4), Bluegrass (approximately Economic Areas 6 and 7), and Eastern (approximately Economic Areas 5, 8, and 9). Metropolitan areas (Jefferson, Fayette, Kenton and Campbell, Boyd, and Henderson counties) were analyzed separately.

Most of the counties in metropolitan areas grew rapidly but at decreasing rates of growth from 1820 to 1930. Thereafter, growth was again faster, but fluctuating. In the Eastern Region, most counties which maintained stable boundaries long enough to show a trend increased at decreasing rates up to 1930. The counties in this region fluctuated during the next twenty years, then practically all declined between 1950 and 1960. The Bluegrass Region is one of mixed growth. Its central and western parts show little change or at best a slight growth during most of the 140 years. The northern Bluegrass counties had a nearly growth, up to 1880, and they and the eastern Bluegrass counties have declined during the remaining years. In the Western Region most counties grew between 1820 and

1900, but the rates of growth declined; during the present century all but four counties decreased in population. The Purchase generally had the same pattern of growth and decline, except that its early growth was extremely rapid.—George A. Hillery, Jr.

Economic status and attitudes of older men in rural and urban Kentucky.— In 1959, data were obtained from a sample of 532 men aged 60 and over living in rural Casey county and in the Lexington metropolitan area. Urban men had markedly higher average incomes than the rural men—$2,256 and $815, respectively. Despite the economic losses which occurred with advances in age (in employment, in income, in housing, and in property owned), it was the younger men rather than the older men who felt more deprived. It was the younger men (aged 60 to 64) and not the older men (75 and over) who expressed the greater dissatisfaction with their economic situation. With advances in age, the men appeared to have made adjustments to their economic conditions.— E. Grant Youmans.

REGULATORY AND INSPECTION SERVICES

Creamery license section.— Licenses to buy milk or cream from producers issued and in force totaled 246, all of which were renewals. The total included 1 creamery, 17 cheese plants, 12 condenseries, 74 milk plants and ice cream manufacturers, and 142 cream-buying stations.

Authority to test for the period ending June 30, 1962 was issued to 434 operators of the Babcock test. These included 388 renewals, 25 licenses issued since July 1 following satisfactory examination, and 21 permits pending examination issued since July 1.

Testers on permit given examinations for license during the year totaled 50; of these testers examined 48 passed, 2 failed, and of those failing, 2 qualified later.

Persons who are authorized to sample and weigh for the period ending June 30, 1962 total 469. Of this number 370 hold licenses, 322 having renewed July 1 and 48 having been examined and found qualified since July 1, 1961. Twenty-three were examined and found qualified between January 1 and June 30, 1961. The remaining 99 hold permits pending examination. The above total (469) includes persons who sample and measure milk in farm bulk tanks; they number 295 of which 228 are licensed.

A total of 9,585 milk and cream test bottles, cream test weights and milk pipettes were calibrated for accuracy. Items of operating equipment in use found on inspections to be incorrect or defective and possible cause of inaccurate weights or tests were: hot water baths, 5; centrifuges, 3; pipettes, 2; test bottles, 46; lights, 5; refrigerators, 2; scales, 12; automatic samplers, 7; centrifuge heaters, 6; weigh tanks, 2; and acid dispenser, 1. These were condemned and ordered to be replaced or repaired.

There were 10 milk weighing tanks checked for accuracy of mixing.

During the year 576 inspections, including 13,373 tests were made.

Operators were graded as follows: A & B (satisfactory), 494 operators; C (unsatisfactory), 67; and D (probation), 15.

At the close of the year (December 31, 1961) all buying places have been licensed. All buyers have according to records licensed samplers and weighers and licensed testers as required by the law.

Receipts for the year were as follows:

Operators Licenses	$ 2,749.50
Buyers Licenses	9,440.00
Glassware, testing and stamping	290.39
Checkoff Receipts	20,703.95
Total Receipts	$33,183.84

The receipts include remittance reports No. 2382 dated January 26, 1961 through No. 2418 dated December 27, 1961, inclusive.

Feed, fertilizer, and pesticide control.— A total tonnage of 456,805 tons of mixed fertilizer and a total of 113,898 tons of fertilizer materials were distributed in Kentucky in 1961 or a grand total of 570,703 tons. This tonnage is 1.2% greater than that sold in 1960.

During 1961, 4,359 samples of fertilizer were taken and analyzed. This is one sample for every 13 tons sold.

The total number of determinations for protein, fat, fiber, minerals, vitamins and drugs in feed samples equaled the total of previous years. The number of official feed samples, 3,316, was slightly under the number for 1960. Analysis of drugs in feed was considerably expanded, accounting for maintenance of the total number of determinations.

The tonnage of feed sold, based upon tonnage reports and tag sales was 576,920 tons.

Two hundred ninety-five samples of pesticides were analyzed. Eighty-nine of these were in pesticide-fertilizer combinations. DDT was the predominant pesticide determined.

Nursery inspection.— The nursery industry has continued to expand in both acreage production and dollar volume of products and services sold. Kentucky nurserymen have enjoyed a fair share of this expansion. The common nursery pests have given comparatively little concern. Our usual educational information has been adequate in most cases. Some additional research information is needed in connection with some of the wood-boring insects, the spider mites, and thrips—especially in relation to the possible use of systemic insecticides.

The soybean cyst nematode problem in Fulton and Ballard counties has expanded some in Fulton County. There has been no additional properties found to be infested in Ballard county. It has been necessary to consolidate the regulated area in Fulton county on an area basis rather than on a property basis. This has been done in order to make the administration of the regulations more orderly and efficient. It is working satisfactorily.

The Japanese beetle problem is reaching a climax for decision.

Because of the increased areas infested within the borders of several of our neighboring states the whole regulatory problem is under serious discussion. There is a very real possibility that Kentucky will be placed under quarantined status with a small area in Kentucky, known as greater Cincinnati, placed under regulation.

Additional areas in Pike and Whitley counties were soil treated during September by use of the Department of Agriculture plane. An area on the U of K Campus and a few areas on the eastern side of the city of Lexington were soil treated, using ground equipment. Other areas in Kentucky showed excellent control results.

Additional survey efforts failed to reveal additional white-fringed beetles. It is now believed that our prompt soil treatment of fourteen acres in the City of Fulton, where one white-fringed bettle was found during 1960, was adequate. Thirty pounds per acre of 10% granular heptachlor was used in both white-fringed and Japanese beetle soil treatments.

Seed testing.— During the year 7,757 samples of seed were tested. Of this total number 1,071 were official samples taken by inspectors from the stock of wholesale and retail merchants. The remaining 6,686 samples were service samples sent to the laboratory by farmers, seedsmen and others. The total samples included 3,596 of grass seed, 1,928 of legumes, 1,305 of cereals, 713 of tobacco, and 928 of miscellaneous seed (lawn mixtures, rape, vegetables, etc.). Of all samples 5,244 were analyzed for purity and 7,464 tested for germination.

Our laboratory collaborated with the Association of Official Seed Anaylsts of North America on referee samples.

ROBINSON SUBSTATION

Evaluation of commercially available dent corn hybrids.— Sixty-four hybrids used in this evaluation experiment at the Substation varied in production from 107.0 to 163.3 bushels per acre. Considerable variation was shown among all the hybrids for resistance in lodging, ear height, and resistance to the Northern and Southern corn leaf blight.

Fifty yellow hybrids averaged 133.2 bushels per acre with an average moisture content at harvesting of 22.6 percent. Fourteen white hybrids ranged in production from 127.5 to 147.3 bushels per acre with an average yield of 139.6 bushels per acre and a moisture content at harvesting of 22.9 percent.— Frank A. Loeffel, Charles M. Derrickson, and James E. Dalton.

Sorgo variety test.— Twelve sorgo varieties were grown at the Substation. Stalk samples of each variety were sent to the U. S. Department of Agriculture, Sugar Crop Field Station, Meridian, Mississippi for milling, juice analysis, and sirup processing.

Varieties yielding the highest tons per acre of stripped stalks were Wiley, 24.9; Umbrella, 23.2; White African, 23.1; Tracy, 21.7;

and Sugar Drip, 21.7. The remaining varieties used in this test listed in their order of production were Ky. 58-209, Mer. 56-12, Sart. Mer. 59-1, Williams, Mer. 59-9, and Mer. 58-13.

The average yield of these twelve varieties was 19.2 tons per acre of stripped stalks. Their average days to harvest was 129.— James F. Shane, Charles M. Derrickson, and James E. Dalton.

Western crossbred ewes mated to slow, medium, and rapid gaining Southdown rams.— This is the fourth year of a five-year experiment designed to study the progeny of slow, medium, and rapid gaining performance-tested Southdown rams when mated to Western crossbred ewes.

All ewes were managed and fed together except during the breeding season, when they were divided into three groups. After lambing, ewes having twin lambs were separated from the ewes having single lambs. A creep ration consisting of 73.5 percent cracked yellow corn, 10 percent soybean oilmeal, 15 percent oats, and 1½ percent aureomycin crumbles was fed to both groups of lambs.

Lamb weights were recorded at birth, 28 days, 56 days, 100 days, and at slaughter time. Twin lambs were slaughtered by the University Meat Laboratory after reaching a weight of 85 pounds. Detailed carcass data, such as dressing percentage, cutting percentage, and carcass grades, were determined at this time. All lambs, both singles and twins, graded prime or choice.

The average daily gain of the lambs from the rapid gaining ram group was 0.54; from the medium gaining ram group, 0.51; and from the slow gaining ram group, 0.47.— P. G. Woolfolk, Charles M. Derrickson, and James E. Dalton.

Effects of antibiotics in laying rations.— Approximately 200 White Plymouth Rock and 200 New Hampshire pullets which had been range-raised were housed by breeds in four 15 x 30 foot pens in a plastic laying house. The experiment was designed so that there was a pen of 100 pullets of each breed on the control diet and a pen of each breed on the diet containing 40 grams per ton of an antibiotic mixture containing streptomycin and procaine penicillin.

Egg records, and feed consumption and mortality records were kept. Each week one day's eggs were weighed to obtain egg weights. In January, April, and June one day's eggs were sent to the University where egg quality and egg shell thickness measurements were obtained. There was very little difference in production among the White Plymouth Rock pullets with or without antibiotics in the diet. However, the use of antibiotics in the feed of the New Hampshire pullets produced an increase of 6 eggs per pullet over the six-month period. The feeding of antibiotics reduced mortality slightly for each breed. There were no improvements in feed utilization, egg weight, egg quality, or shell thickness.

An interesting sidelight of this trial was the fact that excellent production was obtained with a very simple laying diet.— W. M. Insko, Jr., John J. Begin, Charles M. Derrickson, and James E. Dalton.

Effect of oats in laying diets.— A feeding trial involving 560 Single Comb White Leghorn pullets divided into four equal pens was designed to study further the optimum levels of ground whole oats to be used in all-mash laying diets for hens on the floor. The effect of a crude fungal-bacterial fermentation enzyme supplement on the utilization of diets containing high levels of crude fiber in the form of whole ground oats was also studied. The basal diet was a ration high in energy and low in fiber.

The experimental results indicate the addition of 30 percent whole ground oats to the diet stimulated egg production 2 percent above that obtained on the basal diet, and the addition of 50 percent oats depressed egg production 5 percent below that of the basal diet. The highest rate of egg production was obtained when 0.3 percent enzyme supplement was added to the diet containing 50 percent oats. The enzyme-supplemented diet was improved by 6 percent over the 50 percent oat diet without enzyme supplementation. Each addition of whole ground oats increased the amount of feed required to produce a dozen eggs. The addition of the enzyme supplement had no effect on the utilization of feed for egg production. Laying house mortality was the lowest on the 30 percent oat diet and was approximately equal on the other diets.— W. M. Insko, Jr., John J. Begin, Charles M. Derrickson, and James E. Dalton.

Effects of protein supplements for replacement chicks.— Two experiments were conducted to investigate the influence of various protein supplements on growth, mortality, and feed utilization of chicks raised for flock replacement. In trial one 650 Single Comb White Leghorn pullet chicks, and in trial two 924 Hybrid pullet chicks were divided into four pens, each with equal numbers.

A basal diet composed of corn, soybean meal, vitamins, and minerals was compared with diets in which 15 percent of the total protein was supplied by: (1) meat scraps, (2) fish meal, or (3) a combination of meat scraps and fish meal. The birds were weighed individually at ten weeks of age.

In the first trial involving White Leghorn pullets the addition of fish meal to the diet resulted in a significant decrease in growth. There is no explanation why fish meal should have depressed growth since fish meal is generally regarded as an excellent protein supplement. The data indicate that mortality was not influenced by diet and that feed utilization was improved by the presence of meat scrap in the diet.

In the second trial in which hybrid pullets were used the ten-week weights indicate no difference among the protein supplements The data further revealed no differences in mortality attributable to diet; however, feed conversion was improved by the addition of meat scraps or fish meal.— W. M. Insko, Jr., John J. Begin, Charles M. Derrickson, and James E. Dalton.

Range vs confinement raising of pullets.— A trial was conducted to compare the growing of late-hatched pullets in confinement and

on range. Growth, mortality, and feed consumption were observed as a measure of results.

At ten weeks of age 895 pullets were divided into two groups. One group of 448 pullets was placed in pens in the brooder house and the other group of 447 pullets was placed on range. Both groups received the same growing diet and whole oats free choice. At 20 weeks of age the birds were weighed individually. The pullets raised in confinement were significantly heavier than the birds raised on range. Mortality from each group was extremely small; only three birds were lost in the brooder house and only one bird on range. The birds reared on range with free access to grass consumed on the average 3.7 pounds of feed less per bird than those grown in the house. Both groups ate approximately the same amount of whole oats, the difference in the amount of feed consumed being primarily in the mash.— W. M. Insko, Jr., John J. Begin, Charles M. Derrickson, and James E. Dalton.

Greenhouse tomato mulching test.— Five different types of mulches were tested with tomatoes under greenhouse conditions. The mulches used were black plastic, clear plastic, sawdust, well-rotted straw, and peanut hulls. A check plot was tested for comparison.

The Michigan-Ohio Hybrid, a fusarium wilt resistant variety, was used in both the spring and the fall test. Yields ranged from 8.88 to 12.40 pounds per plant for the spring crop and 5.70 to 7.03 pounds per plant for the fall crop.

Early results of this experiment tend to prove the peanut hulls, sawdust, and straw superior to the two types of plastics and the check. This mulching test will be continued for several crops to determine the influence of the mulch incorporation on the soil fertility and on quality and quantity of fruit in subsequent tomato crops. The following is a summary of these results given in pounds per plant:

	Peanut Hulls	*Sawdust*	*Straw*	*Clear Plastic*	*Black Plastic*	*Check*
Spring	12.40	11.00	11.82	9.31	8.88	9.64
Fall	7.03	6.86	6.77	5.98	5.79	6.24

— Donald J. Cotter, Charles M. Derrickson, and James E. Dalton.

Blueberries.— Seven varieties of blueberries planted in 1958 have continued excellent growth, with a heavy yield this year.

The highest yielding variety for these 4-year old plants was the Berkley variety, with an average of 7 pints per plant. The Herbert variety was second with an average of six and one half pints per plant. The following varieties are listed in order of production for the 1961 yields: Berkley, Herbert, Bluecrop, Earley Blue, Coville, Concord, and Jersey.

All missing plants were replaced in March 1961. The Jersey and Concord varieties continue to show poor stand and lower yields than the other five varieties.— Carl Chaplin, Charles M. Derrickson, and James E. Dalton.

Dwarf apple orchard.— The dwarf apple orchard which was planted in March 1957 continued to bear a good scattering of fruit. The varieties on the Malling IX root stock produced more apples per tree than the varieties on the root stock of Malling VII.

The following varieties are listed in their order of production: Triple Red Delicious, Yellow Delicious, and Stayman Winesap. The original Jonathan variety was replaced in March 1960 with the McIntosh variety. Both the Malling VII and Malling IX of the McIntosh variety have made excellent growth in the past two seasons, but they have not had time to bear fruit.— Carl Chaplin, Charles M. Derrickson, and James E. Dalton.

One-season results from three replicated areas using three different silvicides.— In the summer of 1960 treatment was applied to cull beech in three replicated plots on the Robinson Forest. The object was to compare cost and results using the three most common silvicides— namely, sodium arsenite, trinoxol 2,4,5-T, and ammate (ammonium sulfate).

The sodium arsenite was applied by cutting a frill around the tree with a hand axe. The frill was cut just deep enough to reach the wood; then the frill was filled just enough to prevent overflow.

The trinoxol 2,4,5-T was applied by cutting a frill around the tree with an axe and the frill was sprayed until overflow occurred; then the base of the tree was sprayed to just-at-the-run-off point from the frill down to the root collar or the ground level.

The ammate was applied by cutting a frill around the tree with an axe and the ammate crystals applied all around the frill by hand until the frill was full of the ammate crystals.

Following is a table showing cost per acre of the various poisons:

	Sodium Arsenite	*Trinoxol 2,4,5-T*	*Ammate*
Protective material	\$0.03*	\$1.62	\$ 8.18
Poison	\$0.63	\$2.39	\$ 2.38
Labor	\$1.64	.....	.....
Total cost per acre	\$2.30	\$4.01	\$10.56

* Korodex 71 spread on the hands and forearms to prevent any possible absorption of the arsenite by the skin.

The leaves on the trees treated with the arsenite began to turn brown and dry up about 10 days after the treatment. Results from the treatment with 2,4,5-T or ammate didn't show up in the leaves immediately. In the very late summer some of the leaves on the trees treated with ammate began to turn brown.

In middle summer of 1961 all trees in all three areas were thoroughly checked and all dead trees were noted. Dead trees were taken as those that had no green leaves on them at that time. Below is a table showing the percentage of the trees that were dead, based on DBH of all three plots and for the three different poisons:

	Sodium Arsenite	*Trinoxol 2,4,5-T*	*Ammate*
Percent dead trees based on DBH	47.7%	6.3%	19.4%

The lower cost and the faster results of the sodium arsenite would

tend to overcome the danger of handling it. With properly instructed personnel and close supervision, sodium arsenite can be used without undue danger to people handling it or to wild life.— Milton Noble and O. M. Davenport.

Time and cost involved in building truck roads near ridge tops and a comparison of roads on or near ridge top with those from ridge top off to branch.— One of the major obstacles to any forest management, logging or fire control in most of the hilly type topography that characterizes Eastern Kentucky is the inaccessibility of much of the area. This has been especially true on the University of Kentucky's Robinson Forest, where it requires up to 3 hours of walking time to get to some of the area.

In 1960 a major road building program was started on the forest after the Robinson Substation acquired a new TD-15 International tractor equipped with a bull grader.

During the summer of 1961 the road building has been in the Clemons Block of the forest. Based on 9.3 miles of the ridge top road, it took 15 days to make the first cut, which was as light as possible. In the first cut or "break through" just enough cut was made to allow the tractor to go through and all the trees and bushes were cut and pushed out of the way. It took 20 more days to make the final cut and grade, or a total of 35 days for the 9.3 miles of road. The average cost per mile of this ridge top road was $156.39. This cost includes the original reconnaissance and marking of the roadway.

From the 9.3 miles of ridge road as previously mentioned, two roads were built off the hill to existing bottom roads. One of these roads was 1.1 miles long and the other 1.8 miles. The 1.1 miles of road required 11 days to build and the cost per mile was $449.00. The 1.8 mile road took 17 days to complete with a cost of $427.39 per mile. The cost of these two roads averaged $438.20 per mile. Cost on these roads does not include blasting of rock ledges that may be encountered, especially on roads leading off the hill. The roads averaged 12 to 14 feet wide, wide enough to permit logging trucks to operate on them.— Milton Noble and O. M. Davenport.

Importance of timber quality.— In the past timber owners usually sold their timber by the "boundary" for a lump sum, with little or no knowledge of the volume involved and practically no information on quality of the timber or sawlogs.

A few years ago a system of standard log grades was developed to indicate quality of sawlogs. These grades can be applied to standing timber. These log grades are based on the standard grades of lumber of the National Hardwood Lumber Manufacturing Association. There are three commercial or factory grades of logs known as factory No. 1, No. 2, and No. 3. A factory No. 1 log saws out a higher percentage of No. 1 common lumber and better than the other two grades.

The difference in value of the different log grades was demonstrated on the Robinson Forest recently by cutting Red Oak logs

and getting some factory No. 1, factory No. 2, and factory No. 3 logs. These logs were sawed into standard 4/4 lumber, graded and valued according to the current lumber market at that time.

The No. 1 factory logs yielded lumber valued at more than $150 per thousand board feet. The No. 2 logs yielded lumber valued at about $107 per thousand board feet and the No. 3 log produced lumber worth about $63 per thousand board feet.

The cost of producing lumber from logs of the different grades ran about the same for each grade, so it is easy to see that the margin of profit is considerably higher for the better grade logs than from the poorer.

A sawmill operator could have paid $30 per thousand board feet more for the No. 2 logs than for the No. 3, $60 more for the No. 1 log than the No. 3, and would still have ended up with a greater margin of profit.

This demonstration points out the importance of quality as well as quantity when selling or buying logs or standing timber.— Milton Noble and O. M. Davenport.

WESTERN KENTUCKY SUBSTATION

Dairy breeding and production.— The registered herd of Jerseys consists of approximately 30 cows and 30 head of heifers and calves. From December 1, 1960 to December 1, 1961, the average actual production was 7,522 pounds of milk and 408 pounds of butter fat per cow. The dairy produced 31 percent of the total farm income during this period. The best Jersey blood lines in Kentucky are represented in the herd.

Dairy facilities have been gradually modernized in recent years, thus increasing the demonstration value of the enterprise. This year a pipeline milker was installed in the old stanchion barn with automatic washer and milk meters. Other equipment added in recent years included a bulk tank milk cooler, gutter cleaners and cow trainers.— S. J. Lowry and L. M. Caldwell.

Dairy pasture seedings.— Southland bromegrass produced more satisfactory stands than Kentucky Select orchard grass from late August seedings. As in 1960, poor moisture conditions followed seeding and stands of both grasses and Ladino clover were unsatisfactory. Each year, however, the stand of Southland bromegrass obtained was about 50 percent complete as compared with a 25 percent stand of Kentucky Select orchard grass.— S. J. Lowry and L. M. Caldwell.

Oats in all-mash rations for laying hens.— A feeding trial involving 600 single comb White Leghorn pullets divided into four pens of equal numbers was conducted. This trial was designed to study further: (1) the optimum level of ground whole oats to be used in all-mash laying diets for hens maintained on the floor, and (2) the effect of a crude fungal-bacterial fermentation enzyme supple-

ment on the utilization of diets containing high levels of crude fiber in the form of whole ground oats. The basal diet was a low fiber-high energy diet.

There was very little difference in egg production among the groups receiving the basal, the basal plus 30 percent whole ground oats, the basal plus 50 percent whole ground oats, or the diet containing 50 percent whole ground oats plus 0.3 percent enzyme supplement. Each addition of whole ground oats increased the amount of feed required to produce a dozen eggs. The addition of the enzyme supplement had no effect on the utilization of feed for egg production. The highest rate of mortality was experienced on the high energy-low fiber basal diet, the addition of oats at any level reduced mortality.— S. J. Lowry, L. M. Caldwell, John J. Begin, and W. M. Insko, Jr.

Protein supplements for replacement chicks—Approximately 650 Single Comb White Leghorn chicks were divided equally into four pens in the brooder house. A basal diet composed of corn and soybean meal was compared with diets in which 15 percent of the total protein was supplied by (1) meat scraps, (2) fish meal, or (3) a combination of meat scraps and fish meal. The birds were weighed individually at 10 weeks of age.

The only significant difference in growth between the various protein supplements was due to the addition of fish meal alone to the diets. The fish meal diets produced a significant increase in growth. Mortality was not influenced by diet, and feed utilization was not greatly affected by any dietary treatment.— S. J. Lowry, L. M. Caldwell, John J. Begin, and W. M. Insko, Jr.

Beef cattle.— Forty-two calves, averaging about 530 pounds, were equally divided into 2 groups. One group was wintered to gain at the rate of 1 pound per steer daily and the other at 1.4 pounds daily.

At the beginning of the summer phase, each of the winter groups was equally divided into 2 groups of 10 steers. A group of 10 steers from each of the winter treatments was placed in each of the 2 summer groups.

Lot II steers were fed from a self-feeder during the entire summer phase,(while Lot I steers had pasture until the middle of June and then were fed from a self feeder until the end of the trial. Ground shelled corn was fed to both lots. Soybean meal was added from 0% to 9.5% of the ration as pasture conditions warranted.

Average daily gains, carcass grade, (when Good = 10 and G— =9) and yield for Lot I were 1.87, 9.5, and 62.14, while for Lot II they were 1.86, 9.35, and 61.33. Lot I steers brought $5.09 more than Lot II steers.

Lot I steers wintered at the higher rate of gain, were 28.85 pounds heavier and sold for $7.76 more than steers wintered at the lower level, while in Lot II steers wintered at the low level were 17.85 pounds heavier and sold for $4.06 more than steers wintered at the

higher level.—N. W. Bradley, J. R. Overfield, W. P. Garrigus, and S. J. Lowry.

Yorkshire swine herd performance record project.—A Yorkshire herd was established. Five of the spring litters were performance-tested by feeding a barrow and gilt from each of these litters to a final weight of approximately 200 pounds and then getting carcass data on each carcass.

The results were as follows:

Average number pigs farrowed	11.6
Average birth weight, pounds	2.46
Average number pigs weaned	10.8
Average 21-day weight, pounds	10.54
Average daily gain during test period, lbs.	1.75
Feed per 100 pounds gain	345.00
Average back fat, inches	1.59
Average carcass length, inches	30.52
Lean cuts, % of carcass	54.31
Average loin eye, square inches	3.49
Choice No. 1 carcasses, %	50.00

—C. E. Barnhart, J. R. Overfield, and S. J. Lowry.

Ewe and lamb trial.—The two groups of ewes wintered as ewe lambs on high and low levels of nutrition during the winter of 1956-57 are being used to study the effect of level of wintering ewe lambs on future lamb production and to produce lambs for a creep-feeding experiment. A group of 31 yearling and 3-year-old black face Montana crossbreed ewes were also used to produce lambs for creep feeding.

Lambing percentage and lambs sold per ewe were 100 and .88 for Lot I, the high-wintered group; 115.3 and .85 for Lot II, the low-wintered group; and 109.68 and .77 for the Montana ewes. Only three lambs were born in the 44-day period from January 21 to March 6. On July 31, Lot II ewes were 3 pounds heavier than No. I ewes, while this difference was increased to 5 pounds by December 6. This is the second year that No. II ewes have been heavier than No. I ewes.

Two creep rations were used. Creep Ration I was composed of 90% cracked corn, 10% soybean meal, and 50 grams Aureomycin per ton. Creep II was composed of 67.5% cracked corn, 25% soybean meal, 5.0% alfalfa meal, 1.5% bonemeal, 0.8% salt, 0.2% trace minerals, and 50 grams Aureomycin per ton.

The average market weight, average carcass grade (when Good = 9, Choice = 10, and Prime = 11), average yield and average value per lamb were as follows:

Ewe Lot No.	*Ration No. Creep*	*Market Weight*	*Carcass Grade*	*Average Yield*	*Average Value*
I	I	92.50	10.38	53.70	16.49
I	II	87.50	10.83	55.17	15.92
II	I	88.00	10.40	52.76	15.68
II	II	92.50	10.17	55.13	16.77
Montana	I	90.00	10.33	52.63	15.83
Montana	II	89.67	9.93	51.54	15.71

Of lambs marketed before weaning, those fed creep Ration II were 11 days younger than those fed creep Ration I.—P. G. Woolfolk, J. R. Overfield, and S. J. Lowry.

Use of LP gas in curing dark fire-cured tobacco.—The early stages of curing dark fired tobacco require close attention in maintaining the proper temperature and humidity in the barn. In the past this has been accomplished by the use of wood fires and wet sawdust. This required the almost constant presence of an attendant during certain stages of curing. In recent years, due to smaller tobacco allotments and the shortage of farm labor, farmers have not given this close attention to the curing. The wood fires often become too hot, especially during the night, with resulting damage to the crop.

Gas burners are easily adjusted and can be depended upon not to overheat. With periodic checking of the tobacco two or three time during the day, the burners and ventilators can quickly be adjusted to more nearly maintain the desired temperature and humidity. The gas heat is used as needed during the yellowing and browning stages and until a solid color is obtained. After the color is set the tobacco is not so easily damaged by extremes in temperature. At the stage for shrinking the stems, wood fires are started and smoking is continued until the tobacco has the desired finish.—Leo A. Link.

Rates of limestone for corn and alfalfa.—The Princeton Substation is cooperating with experiment stations from several of the southern states in a regional lime experiment. The trend toward high rates of acid-forming fertilizer materials and the increasing use of forage crops that are sensitive to soil acidity make it highly desirable that an attempt be made to bridge existing gaps in past data and in current research on liming. The influence of depth of mixing on root extension and the relative effectiveness of various rates when mixed with different volumes of soil are of special importance in this connection.

Alfalfa and corn are being used here as examples of forage and row crops. The rates of limestone range from none to 12 tons per acre. Both dolomitic and calcitic limestones are being included in the test. Only yield differences have been studied so far. During the three years the test has been under way, significant yield differences have been obtained, both for alfalfa and for corn, between the limed and unlimed treatments, but not for various rates of limestone. So far the 12 tons per acre rate, which was thought to be excessive, has not depressed yields.—Leo A. Link.

Dark tobacco variety tests.—From 15 to 25 experimental lines of dark tobacco are tested each year for field type and for quality as measured by federal grades. After the tobaccos are studied in the field for type and the cured leaf graded by federal graders, tobacco

buyers from several companies are invited to judge the different lines as to suitability for use in their products.

In addition to developing varieties which are disease resistant, attempts are being made to develop varieties which are especially suited for certain trades, such as rehandling, cutting, and snuff. These varieties are used somewhat interchangeably but should be better suited for certain farmers who through experience are more adept at producing tobacco for a special segment of the tobacco market. During the past year the varieties Ky 155, a cutting type; Ky 156, a rehandling type; and Ky 157, a snuff type were released by the experiment station to seed producers for increase of seed supply.— Leo A. Link.

Forage crops.— Of 42 varieties and seed lots of orchard grass planted in 1960, eight resulted in stands of less than 10 percent and five in stands of 20 to 40 percent. Six of these 13 lots were of foreign origin obtained from retail outlets in the state, 3 from foreign sources, and 4 were from U. S. produced seed obtained from Kentucky seed outlets. Potomac showed the highest rust resistance of the named varieties in the test. Boone was intermediate in rust resistance but better than Ky Select and most of the Kentucky-produced strains.

Data from timothy tests indicated that there was no difference in production and persistence among classes of seed of Clair either along or with alfalfa. All Clair lots were superior to common timothy.

In the second year hay production from a Kenland red clover class and seed-source test, Kenland Breeder was higher yielding than the other classes of Kenland and higher than eight lots of Kentucky-grown common red clover tested.— W. H. Stroube and Randolph Richards.

Grain sorghum.— Yields of the 25 hybrids and open-pollinated varieties in the experiment on the Substation farm ranged from 62.3 to 131.0 bushels per acre, with an average for the experiment of 94.7 bushels per acre. Three Texas Experiment Station hybrids, Tx 601, Tx 611, and Tx 620, each yielded over 100 bushels per acre. The lowest test weight recorded was 57.0 pounds per bushel for the open-pollinated variety Plainsman, and the highest was 61.2 for the open-pollinated variety Combine Shallu.— Randolph Richards.

Soybeans.— Twelve varieties, including new strains that look promising, were compared on silt loam bottom-land soil. Data on yield, maturity date, lodging, height, seed quality, seed size and oil percentage were collected and recorded. Of the earlier varieties, Kent had the highest yield of 35.5 bushels per acre. Clark, another early bean, was unusually low in yield in this test, ranking 10th among the twelve varieties. Hill, a medium-late variety, was the top yielder in the experiment, with a yield of 36.5 bushels per acre. Only three varieties:

Hill, Lee, and Kent; were considered significantly higher in yield than Clark. These three varieties matured later than Clark in this test, which was planted May 26, 1961.— J. F. Freeman and Randolph Richards.

Winter small grains.— Performance trials on barley, oats, and wheat varieties and selections were conducted at the Princeton Substation, Murray Kentucky State College, and Western Kentucky State College. Studies on resistance factors in wheat against hessian fly, loose smut, and leaf rust are progressing slowly but satisfactorily. Date x rate x variety trials with barley and wheat were conducted at the Princeton Substation for the first time this year. Two new Kentucky barley selections, 59-1564 and 59-2231, were outstanding for test weight and straw strength, respectively. Kentucky 54-488 and an Oklahoma selection were two oat selections that had good winter hardiness, test weight, yield, and straw strength. The newly-recommended wheat variety Monon performed very well, having high yields, fair test weight, good straw strength, earliness, and short straw.— Randolph Richards.

Corn.— Sixty-four yellow and white hybrids from experiment station and private companies were each compared at two population levels, 14,000 and 24,000 plants per acre. The experiment had an average yield of 123.6 bushels per acre. The yellow hybrids yielded an average of 121.8 bushels per acre and the white hybrids 130.3 bushels per acre. The average yield of the 24,000 plants-per-acre population was 115.3 bushels per acre, while that of the 14,000 plants per-acre was 132.0 bushels per acre. Lodging was considerably greater at the high population level than it was at the low level. A few hybrids withstood the stress of the higher population and yielded more than they did at the lower population. A.E.S. 809 yielded 118.2 bushels per acre. The average yield of the 24,000 plants-per-acre population was 115.3 bushels per acre, while that of the 14,000 plants acre and had 8.7 percent lodging.— Randolph Richards and Frank A. Loeffel.

Strawberry varieties.— Strawberry varieties now considered as dependable for Kentucky again performed well, such as Tennessee Beauty, Pocahontas, Dixieland, Blakemore, Tennessee Shipper, Earlidawn, and Surecrop. Some new selections that performed well were U.S.D.A. numbers 2601 and 4192, and N.C. 1768. Some other varieties that performed poorly, because of poor adaptation, poor yields, poor stands of plants, leaf troubles, poor fruit characteristics or for several of these reasons were: Catskill, Robinson, Sparkle, Midway, Redglow, Stelemaster, Empire, and Redstar.

Plots harvested their fourth season on a choice strawberry location produced much heavier than second-year harvest plots on a less desirable location.

Red stele disease was serious in many parts of Kentucky during the wet year of 1961. This fact increases the importance of the

Surecrop variety which is resistant to the disease and can be grown on infected soil, while the other standard varieties will not survive such conditions.— W. D. Armstrong.

Elberta peach fertilization plots.— In 1961, these 12-year trees produced their sixth straight crop without a failure, and this is a record for this location.

As a yearly average yield per tree over the past five years (1957-1961), trees getting 1, 2, and 4 pounds of ammonium nitrate per year, applied in the spring, produced 6.4 bushels, 6.8 bushels, and 7.2 bushels per tree respectively. By comparison, other trees getting the same amount of nitrogen, but applied half in spring and half in the fall, averaged 5.6, 6.5, and 7.2 bushels per tree respectively on low, medium and high nitrate trees.

In one-third of the plots where 7 pounds of 5-10-10 fertilizer per tree was used to supply all or a part of the nitrogen and to add phosphate and potash, the 5-year average yield increase was .6 bushel per tree per year, with the only significant difference showing up in 1958.— W. D. Armstrong.

Peach varieties and nectarines.— Newer peach varieties (listed in their order of ripening) that again produced well at Princeton in 1961, in spite of freezes and frosts at bloom time, were: Cardinal, Sunrise, Prairie Sunrise, Late Sunhaven, Redhaven, Golden Jubilee, Goldenred, Envoy, Prairie Rose, Nectar, Halehaven, Fireball, Loring, Ozark, Earlihale, Stoner, Brayberta, Redskin, Elberta (old), Shipper's Late Red, Afterglow, and Laterose.

Earlired, the new U.S.D.A. early variety, again fruited well but all peaches had split seeds. Coronet and Keystone again produced very shy crops. Ranger was unusually hard hit by the spring weather and produced very lightly in 1961. Fairhaven produced heavily, but the fruits at maturity again developed the brown discoloration around the seed; a fault that is eliminating the usefulness of this variety in Kentucky. Rio Oso Gem, July Elberta, H.H. Brilliant, and B7-1029 again had serious leaf spotting and some fruit spotting from the Bacterium pruni disease. Richhaven and Shipper's Late Red Developed many so-called "buttons" or abnormal fruits because of the cold blooming season and poor pollination conditions.

Several new varieties of nectarines fruited for the first time. Much is expected soon from the several promising new varieties of this fine fruit.— W. D. Armstrong.

Summer apple varieties.— It is thought that summer apples offer a great opportunity in Western Kentucky. The following varieties listed in order of maturity from mid-June through August, showed possibilities: Close, Henry Clay, Lodi, Oriole, Mantet, Milton, Melba, Red Melba, Wealthy, Rambo, Boyd Duchess, Polly Eades, Redwell, Paducah and Minjon.

Fenton, now considered to be the same variety as Beacon, again showed internal breakdown, thought to be due to the failure of this

variety to withstand the hot summer temperatures.— W. D. Armstrong.

Pecans and black walnuts.— Additional northern pecan varieties, as well as some hardy type English walnuts, were established on top-grafted trees and additional nursery propagation work was done.

The wet year of 1961 was another bad one for black walnut leaf diseases (principally leaf blight, "anthracnose") at Princeton and over Kentucky, and nuts of a number of varieties and seedling trees did not fill satisfactorily.

Chinese chestnuts continued to be pest-free and to bear well, maturing well ahead of frost. These medium sized trees bear early crops of good tasty nuts.— W. D. Armstrong.

Dwarf apple tree tests.— Limited tests here (started 1957) have indicated that Golden Delicious grafted on Malling VII bear earlier and have a more spreading top than on Malling II, Malling I and Malling XIII. The same is true of McIntosh on Malling VII compared to Malling I and Malling II. Of the above, trees on Malling XIII are larger and more upright and later coming into bearing, followed by those on Malling I.— W. D. Armstrong.

Pear varieties.— Maxine and Ewart had no blight in 1962, retained their foliage well, and produced good yields of high quality dessert pears. They continue to look promising for Western Kentucky. Waite had a medium crop of good quality pears also. Richard Peters and Douglas continued to bear heavy but they are somewhat low in quality and are more adapted to cooking and canning.— W. D. Armstrong.

Fruitful blackberries.— Several promising, upright growing blackberries were fruited in the continuing effort to locate and test some dependable, fruitful varieties and selections. Heaviest 1961 yield was produced by a selection known as Hillenmeyer, closely followed by Darrow and Hedrick. Bailey and Maryland Eldorado were far behind in total yields. The Everbearing Tree blackberry bloomed late and over a long period and ripened its large-seeded, tart berries from mid-July through September.— W. D. Armstrong.

PUBLICATIONS

Annual Report

Seventy-fourth annual report of the Experiment Station (for 1961). William A. Seay, Acting Director, June 1961.

Bulletins

673. Getting established in farming in Kentucky. John H. Bondurant and James Criswell. February 1961.

674. Organization of the Louisville Wholesale Fruit and Vegetable Market, 1959, with changes since 1936. C. D. Phillips. September 1961.

675. Population of Kentucky: changes in the number of inhabitants 1950-60. Gordon F. deJong. December 1961.

Circulars

576. Consumption of Poultry Meats in Kentucky. J. B. Roberts and M. Wightman. January 1961.

Kentucky Farm and Home Science

(A journal of the Experiment Station, issued in the winter, spring, summer and fall.)

Vol. 7, No. 1

Ground-breaking ceremonies staged for Agricultural Science Center (Anon.)
Kentucky research results in brief. (Anon.)
Spray damage to tobacco plants. (Richard Thurston)

Vol. 7, No. 2

Health problems of older persons in Kentucky studied. (E. Grant Youmans)
Earth helps heat greenhouse. (Frank B. Borries, Jr.)
Systematic insecticides provide new method to control Mimosa webworm. (J. G. Rodriguez)

Vol. 7, No. 3

Kentucky research results in brief (Frank B. Borries, Jr.)
Workers speed up beef research. (W. P. Garrigus)
Accelerated ham aging being studied by U. K. meats research staff. (James D. Kemp)

Vol. 7, No. 4

Old-time regular cigarette contains more tobacco than filter type. (Frank B. Borries, Jr.)
Seek ways to cut tobacco labor. (Frank B. Borries, Jr.)
Economic problems of older men. (E. Grant Youmans)
U. K. Agricultural Science Center (Anon.)

Miscellaneous Publication

235. Earth helps heat greenhouse. (Frank B. Borries, Jr.)

Regulatory Bulletins

165. Economic poisons report—1960. March 1961

166. Commercial feeds in Kentucky—1960. April 1961

167. Commercial fertilizers in Kentucky, July-December 1960. April 1961.

168. Seed inspection in Kentucky, May 1, 1960-April 30, 1961. July 1961.

169. Semi-annual report—official fertilizer samples. January-June 1961. December 1961.

Progress Reports

98. Strawberry marketing in Kentucky, 1960. Willard H. Minton. January 1961.

99. Results of hybrid corn performance test, 1960. F. A. Loeffel and J. F. Shanc. January 1961.

100. Cigarette size and composition. William O. Atkinson. January 1961.

101. Results of Kentucky soybean performance and row-width tests, 1960. J. F. Freeman, H. R. Richards and S. H. Phillips. March 1961.

102. Advantages and problems in sheep production. Joe E. Fuqua and George B. Byers. March 1961.

103. Results of Kentucky sorgo performance test, 1960. J. F. Shane. March 1961.

104. Health problems of older persons in rural and urban Kentucky. E. Grant Youmans. May 1961.

105. Economic status and life attitudes of older men in selected rural and urban areas of Kentucky. E. Grant Youmans. September 1961.

106. Comparison of working wives with non-working wives in their food shopping and preparation attitudes and practices. Mildred Wightman and John B. Roberts. September 1961.

107. Economic analysis for the Kentucky state institutional farm system. John G. Stovall, James Thompson, George B. Byers. December 1961.

RURAL SOCIOLOGY REPORTS

RS-10 Population of Kentucky counties and incorporated places, 1960, and changes, 1950-60. George A. Hillery, Jr. January 1961.

SCIENTIFIC PAPERS

Agronomy

Corn yield response to applied phosphorus as affected by rainfall and temperature variables. Englestad and E. C. Doll. Agron. Jour. 53:6, pp. 389-392.

Differences in potassium, nitrogen, and total alkaloid concentration of 10 burley tobacco varieties. C. E. Bortner, A. M. Wallace and J. L. Hamilton. July 22, 1960. Reprinted from Tobacco, New York Vol. 151, No. 4, pp. 20-24 (Tobacco Science Vol. 4, pp. 151-155).

Effect of fertilizer nitrogen on yield and nitrogen uptake by grass-legume pastures. E. C. Doll, A. L. Hatfield and J. R. Todd. Agron. Journ. 53:3, pp. 189-192.

Morphological and chemical properties of important depressional soils of lowlands in the Western Coal Field region, Kentucky. F. R. Cox, Jr., and T. B. Hutcheson, Jr. (1961). Soil Sci. Soc. Amer. Proc. 25:236-239.

Preparation and some properties of soluble succinc dehydrogenase from higher plants. A. J. Hiatt. Plant Physiology 36:552-557. 1961.

Resistance to the wildlife disease in relation to the gene-chromosome set ratio in tobacco. J. H. Smiley and G. W. Stokes. Phytopath 51:174-175. 1961.

Some characteristics of perennial and annual ryegrass x tall fescue hybrids and of the amphidiploid progenies of annual ryegrass x tall fescue. R. C. Buckner, Helen D. Hill, and Paul B. Burrus, Jr. Crops Science 1:75-80. 1961.

Some effects of gamma and neutron irradiation of seeds on germination and seedling growth of red clover. N. L. Taylor, Elmer Gray, W. H. Stroube, and W. A. Kendall. Crop Science 1:6, pp. 458-460.

Some effects of temperature and light on growth and flowering of tall fescue, *Festuca arundinacae* Schreb. I. Vegetative Development. W. C. Templeton, Jr., G. O. Mott, and R. J. Bula. Crop Science 1:216-219. 1961.

Some effects of temperature and light on growth and flowering of tall fescue, *Festuca arundinacae* Schreb, II. Floral Development. W. C. Templeton, Jr., G. O. Mott, and R. J. Bula. Crop Science 1:283-286. 1961.

ANIMAL HUSBANDRY

Breeding performance in ewes following synchronizing of estrus by feeding provera. J. S. Evans, E. C. Simpson and R. H. Dutt. J. Animal Science 20:969. November 1961.

Effects of smoking and smoking temperatures on the shrinkage, rancidity development, keeping quality and palatability of dry-cured hams. James D. Kemp, William G. Moody and James L. Goodlett. Food Technology 15, 267-270, 1961.

Processing costs, market values, and consumer acceptance of light and normal weight hogs. R. A. Field, W. Y. Varney, and James D. Kemp. J. An. Sci. 20, 742-746, 1961.

ANIMAL PATHOLOGY

Blood and plasma volume, total serum protein, and electrophoretic studies in helminthic diseases. S. E. Leland, Jr. Annals of the New York Academy of Science, Vol. 94, article 1, 163-182, August 31, 1961.

Comparison of thiabendazole, ruelene and phenothiazine for anthelmintic activity in sheep. J. H. Drudge and George Elam. J. Parasitol. 49 (Sec. 2), 39-40, 1961.

Critical tests with the organic phosphate insecticide, dimethoate, against gastrophilus spp. in the horse, with observations on its anthelmintic action. J. H. Drudge, S. E. Leland, Jr., Z. N. Wyant, G. W. Elam and E. T. Lyons. Am. Jour. Vet. Res. Vol. XXII, No. 9, 1106-1111, November 1961.

Equine salmonellosis. John T. Bryans, Edward H. Fallon and Barbara P. Shephard. Cornell Vet. Vol. LI, No. 4, 467-477, October 1961.

Immunization against viral rhinopneumonitis of horses with live virus propagated in hamsters. E. R. Doll. Jour. Am. Vet. Med. Assoc. 139, 1324-1330, December 1961.

In vitro cultivation of the parasitic stages of *Cooperia punctata, Cooperia onchophora, Ostertagia ostertagi* and *Ostertagia circumcincta*: A preliminary report. S. E. Leland, Jr. Jour. Parasitol, 47 (Sec. 2) 21, 1961.

In vitro growth requirements of parasitic nematodes. I. A simple prismatic device for viewing parasites which are within tubes, flasks, or vials. S. E. Leland, Jr. Jour. Para., Vol. 47, No. 4, 623-624, August 1961.

Influence of superimposed nematode infection plus grain supplementation on the serum proteins of pastured calves. S. E. Leland, Jr., J. H. Drudge and R. P. Dillard. J. Parasitol. 47 (Sec. 2) 21-22, 1961.

Influenza of horses. E. R. Doll. The American Review of Respiratory Diseases, International Conference on Asian Influenza, Vol. 83, No. 2, 48-53, February 1961.

Isolation of *Vibrio fetus* from the feces of lambs and pen contact transmission of the infection. John T. Bryans and Barbara P. Shephard. The Cornell Vet., Vol. LI, No. 3, 376-383, July 1961.

Observations on the anthelmintic activity of some organic phosphates in beef and dairy cattle. J. H. Drudge, D. Hams, S. E. Leland, Jr., Eugene Lyons and Joe Rust. Vet. Med., Vol. 56, 135-138, March 1961.

Observations on the efficacy of three phenothiazine preparations on a phenothiazine-resistant strain of *Haemonchus contortus*. J. H. Drudge, Z. N. Wyant and George Elam. J. Parasitol. 47, (Sec. 2) 39, 1961.

Parasite control in the horse—The current status of antiparasitic drugs. J. H. Drudge. A.V.M.A. Annual Meeting Program, 70-71, 1961.

Parasitic infections in horses. J. H. Drudge, Vet. Scope, Vol. 1, 2-8, 1961.

Preliminary observations on the resistance of horse strongyles to phenothiazine. J. H. Drudge and George Elam. Jour. Parasitol. 47 (Sec. 2): 38-39, 1961.

Propagation of equine arteritis virus in monolayer cultures of equine kidney. William H. McCollum, E. R. Doll, James C. Wilson, Catherine B. Johnson. Am. Jour. of Vet. Res., Vol. XXII, No. 89, 731-735, July 1961.

Some aspects of experimental infection of the mongolian gerbil (Meriones) unguiculatus with *Trichostrongylus axei*. S. E. Leland, Jr., J. Parasitol, 47 (Sec. 2) 18, 1961.

Studies on trichostrongylus axei (Cobbold, 1879). VII. Some quantitative and pathological aspects of natural and experimental infections in the horse. S. E. Leland, Jr., J. H. Drudge, Z. N. Wyant and G. W. Elam. Am. Jour. of Vet. Res., Vol. XXII, No. 86, 128-138, January 1961.

Synergistic action between phenothiazine and piperazine-carbon disulfide complex

against horse strongyles. J. H. Drudge, Z. N. Wyant, George Elam and G. Rothenberger. Jour. Parasitol. 47, (Sec. 2), 40, 1961.

Dairy Science

A simplified method of obtaining differential and total viable anaerobic counts of rumen bacteria employing sealed small-diameter glass tubing. D. W. Claypool, Don R. Jacobson, and Ralph S. Wiseman. J. Dairy Sci., 44: (1), 174-175. 1961.

Dried skim milk in the calf starter contributes little in a two or three week weaning program for dairy calves. Fred E. Pardue and Don R. Jacobson. J. Animal Sci., 20: (4), 946. 1961.

Fescue toxicity. W. M. Miller and Don R. Jacobson. J. Animal Sci., 20: (4), 960. 1961.

Is incubation for seven days at 5°C adequate for enumerating psychrophilic bacteria in milk? W. E. Glenn, J. Dairy Sci., 44: (6) 1160. 1961.

Levels of deoxyribonucleic acid in bovine spermatozoa and their relationship to fertility. W. R. Summerhill, Jr., and D. Olds. J. Dairy Sci., 44: 548-551. 1961.

Mode of action of penicillin in preventing legume bloat. W. M. Walker and Don R. Jacobson. J. Animal Sc., 20: (4), 961. 1961.

Entomology and Botany

Ecological studies on Oribatid mites with particular reference to their role as intermediate hosts of anoplocephalid cestodes. J. A. Wallwork and J. G. Rodriguez. Jour. Econ. Ent. 54 (4):701-705, 1961.

Effects of gibberellin on nutrition of the mites, *Tetranychus telarius* (L) and *Panonychus ulmi* Koch. J. G. Rodriguez and J. Milton Campbell. Jour. Econ. Ent. 54 (5):984-987, 1961.

Life history of *Macrocheles muscaedomesticae* (Acarina: Macrochelidae), a predator of the house fly. Claude F. Wade and J. G. Rodriguez. Ann. Ent. Soc. Amer. 54 (6):776-781, 1961.

Nutrition of *Macrocheles muscaedomesticae* (Acarina: Macrochelidae) in relation to its predatory action on the house fly egg. J. G. Rodriguez and Claude F. Wade. Ann. Ent. Soc. Amer. 54 (6):782-788, 1961.

Systematic insecticides as soil treatments for control of the mimosa webworm, *Homadaula albizziae*. J. G. Rodriguez. Jour. Econ. Ent. 54 (3):523-525, 1961.

Systemics give control of mimosa webworm. J. G. Rodriguez. Amer. Nurseryman 113 (9): 14, 68-69, 1961.

Resistance in *Nicotiana* to the green peach aphid and some other tobacco insect pests. Richard Thurston. Jour. Econ. Ent. 54 (5):946-949, 1961.

Home Economics

Relations between home experiences and children's use of language in play interactions with peers. Helen R. Marshall. Psychological Monographs 75:5, contrib. no. 509, 1961.

Horticulture

Effect of boron, dextrose, and beta-naphthoxy-acetic acid on fertilizer requirements and yields and fruit quality of tomatoes. E. M. Emmert. American Society for Horticultural Science, Vol. 77, pp. 494-499, 1961.

Effect of circulating air on the environment and tomato growth response in a plastic greenhouse. D. J. Cotter and R. T. Seay. American Society for Horticultural Science, Vol. 77, pp. 643-646, 1961.

Effect of gamma irradiation on the incidence of black spot, and ascorbic acid, glutathione and tyrosinase content of potato tubers. D. J. Cotter, and R. L. Sawyer. American Potato Journal, Vol. 38, No. 2, pp. 58-65, February, 1961.

Effect of low dosage irradiation and subsequent storage on acceptability of broccoli, sweet corn, and strawberries. D. C. Martin and D. A. Tichenor. Food Technology.

Effect of over-fertilization on container-grown plants. J. D. Kelley. Proceedings, 10th annual meeting Plant Propagation Society, December 1-3, 1961, pp. 58-63.

Growth Response and leaf composition of *Ilex crenata* Rotundfolia and *Euonymus alatus* 'Compacta' as influenced by water soluble and slow release forms of nitrogen and potassium. J. D. Kelley. Amer. Soc. Hort. Sci. Vol. 77, p. 53.

Research work in ornamental horticulture. J. D. Kelley and J. W. Herron. Fifth annual report on ornamental research in each southern state, Southern Nurserymen's Assn., pp. 30-32, February 1961.

Use of giberellic acid to prolong the keeping quality of Easter lilies. J. D. Kelley. Presented at the 58th annual meeting of the American Society for Horticultural Science, Vol. 77, page 90, 1961.

Poultry Science

A comparison of calculated and determined metabolizable energy values. J. J. Begin. Poultry Science 40: 674-676. 1961.

Effect of cellulose with and without supplemental energy in chick diets. J. J. Begin. Poultry Science 40: 892-900. 1961.

Effect of dietary fat and cellulose on apparent calcium digestibility in growing chickens. F. D. Griffith, R. B. Grainger and J. J. Begin. Poultry Science 40: 1492-1497. 1961.

Effect of tapazole on growth of hybrid cockerels. H. R. Wilson and D. W. MacLaury. Poultry Science 40: 890-892. 1961.

Rural Sociology

Administrative Intelligence as an area for for operational research and evaluation in community development programs Frank A. Santopolo. Community Development Review. Vol. 6, No. 2, June 1961, pp. 63-67.

Felt population pressures in India: methods of identification. George A. Hillery, Jr. Population Review, Vol. 5, No. 2, July 1961, pp. 41-49.

The folk village: a comparative analysis. George A. Hillery, Jr. Rural Sociology, Vol. 26, No. 4, December 1961, pp. 337-353.

Peru: coltivatori non proprietari, Quaderni di sociologia rurale, Anno 1, Numero 3, 1961, pp. 78-90. Thomas R. Ford.

Pessimism among older rural and urban persons. E. Grant Youmans. Journal of Health and Human Behavior. Vol. 2, Summer 1961. pp. 132-137.

Religious thought and beliefs in the southern Appalachians as revealed by an attitude survey. Thomas R. Ford. Review of Religious Research, Vol. 3, No. 1, Spring 1961. pp. 2-21.

Retirement patterns among rural and urban men. E. Grant Youmans. Proceedings: Association of southern agricultural workers, Vol. 1, 1961, pp. 1-14.

Some behavioral factors in the control of tuberculosis in a rural county. Marion Pearsall. American Review of Respiratory Diseases, 1961.

Structure of organizations in cooperative association. Eldon D. Smith and C. M. Coughenour. American cooperation, 1961. Washington 25, D. C.: American Institute of Cooperation, 1961.

Theses for Degree of Ph.D. or M.S., University of Kentucky, Concerning

Experiment Station Projects (Unpublished)

Agronomy

Dowdy, R. H. Effect of exchangeable potassium level and drying on release and fixation of potassium by selected Kentucky soils.

Ross, S. J., Jr. A study of titration curves of selected Kentucky soils as bases for predicting amendments for soil reaction control.

Amos, Dan. The effect of aluminum on the uptake of copper by wheat plants.

Capito, David A. A comparison of potassium uptake from soils of differing bulk densities by two varieties of burley tobacco.

Terry, David L. Characterization of the mechanisms controlling solution phosphate in a Memphis silt loam soil.

Animal Husbandry

Ericsson, Ronald J. Testicular temperature and semen production in rams following removal of the scrotal wool.

Rogers, Robert A. Effects of partial pumping on the characteristics of aged hams.

Dairy Science

Caudill, J. H. Effect of aging of semen and fertility of dairy bulls on delayed returns.

Cooper, Tommye. Comparison of original pedigree information with artificial breeding proof of sires used by the Kentucky Artificial Breeding Association.

Miller, W. M. Cause of uncomplicated legume bloat and the mode of action of penicillin in its prevention.

Pardue, Fred E. Performance of dairy calves weaned at 3-weeks of age and fed vegetable vs. animal source protein in the dry matter.

Vedamuthu, Ebenezer, R. Associative action or synergism in psychrophiles isolated from milk.

Entomology and Botany

Wade, Claude F. Studies of some mites that are predators of the house fly.

Poultry Science

Otis, Jack Spencer. The heritability of rate of oxygen consumption in chickens.

Plumley, Sonny Eugene. A Comparison of the tolerance of chick embryos of two breeds to elevated temperatures.

Rural Sociology

George, Kochuparampil Mammen. Association of selected economic factors with net migration rates in the southern Appalachian region, 1935-57.

Agricultural Economics

Bates, Clyde T. An analysis of production and prices of white and yellow corn in Kentucky.

Hubbard, John W. A stochastic analysis of changes in sizes and distributions of grade of dairy herds in the Louisville milkshed, 1950-60.

Martin, James C. Problems of defining the size and shape of fluid milk market areas in Kentucky.

Steele, Howard Loucks. The use of projection in food marketing surveys.

FINANCIAL STATEMENT

Statement of Current Income and Expenditures
of Federal Funds and Offset Funds Thereto
for Fiscal Year Ending
June 30, 1961

INCOME

Federal:		
Hatch Amended	$748,187.00	
Regional Research Fund 3(c)3	129,402.00	
AMA Title II	17,500.00	
Total Federal Funds		$ 895,089.00
Non-Federal Funds		1,587,198.26
Total Federal and Non-Federal Funds		$2,482,287.26

EXPENDITURES

	Federal	*Non-Federal*	*Total*
Personal Services	$726,525.69	$ 946,878.13	$1,673,403.82
Travel	14,029.32	16,374.63	30,403.95
Transportation	493.90	1,051.44	1,545.34
Communication Service	1,476.70	11,643.14	13,119.84
Rent & Utility Service	689.11	69,428.29	70,117.40
Printing	1,620.07	6,063.14	7,683.21
Contractual Service	20,512.05	81,941.94	102,453.99
Supplies & Materials	55,849.39	272,827.83	328,677.22
Equipment	59,408.92	112,377.18	171,786.10
Lands & Structures		46,372.16	46,372.16
Taxes & Assessments	14,483.85	22,240.38	36,724.23
Total	$895,089.00	$1,587,198.26	$2,482,287.26

1.8M—6-62